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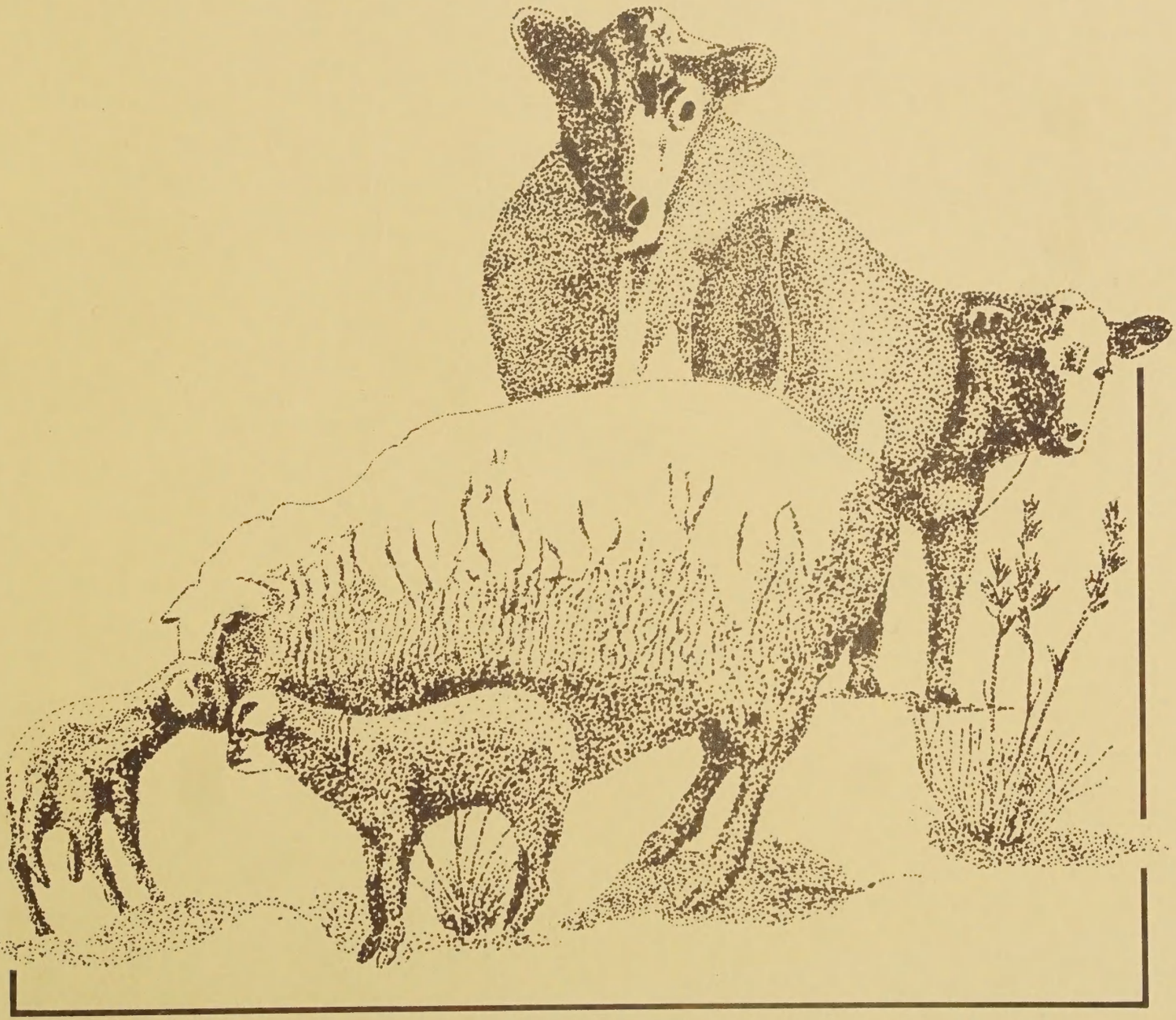
Guidelines for Forage Resource Evaluation within Central Oregon Pumice Zone



GUIDELINES FOR FORAGE RESOURCE EVALUATION

WITHIN

CENTRAL OREGON PUMICE ZONE

Leonard A. Volland

Plant Ecologist

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Forage rating guides are provided for forest and non-forest rangeland within the central Oregon pumice zone. The pumice deposition zone encompasses portions of the Winema, Deschutes, and Fremont National Forests. The guides are intended to be used by range, wildlife and forestry technicians for evaluating the impact of cattle, sheep, and mule deer utilization on native vegetation. The treatment response of the more common plants to burning and logging is discussed but no evaluation criteria are provided. The numerical guides are designed to estimate a forage rating for a particular site using data collected from either the three-step (loop frequency) method or a number of larger microplots. The forage guidelines are intended to be compatible with the plant associations as described for central Oregon.

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Guidelines for Forage Resource Evaluation
within
Central Oregon Pumice Zone

AREA DESCRIPTION

The central Oregon pumice zone comprises approximately 2,780,000 acres within the Deschutes, Fremont, and Winema National Forests. The zone is broadly delimited as an area extending from the Sprague River on the south to the Warm Springs Indian Reservation on the north and between the Cascade Mountains on the west to the shrub steppe on the east (refer to Figure 1).

General view of central Oregon pumice zone showing mosaic of forested and shrub steppe vegetation north of Sprague River. Undulating topography dissected with fault ridges is typical.

The entire area is covered by recent pumice eruptions from either Mt. Mazama or Newberry caldera. In the northwest portion volcanic sand and scoria deposits from Nash Crater and Blue Lake overlay Mazama pumice. The dacite pumice from Mt. Mazama occurs in two deposits: airborn pumice followed by overland flow pumice. A basic scoria flow occurred after the dacite pumice flow in the vicinity of Crater Lake National Park. The most recent pumice deposit is rhyolitic in mineralogy, and overlays Mazama dacite pumice to the east of Newberry caldera. Each forage rating guide describes the soils and geology for which it can be applied. Often the influence of soil parent material is reflected in the forage production and species composition data.

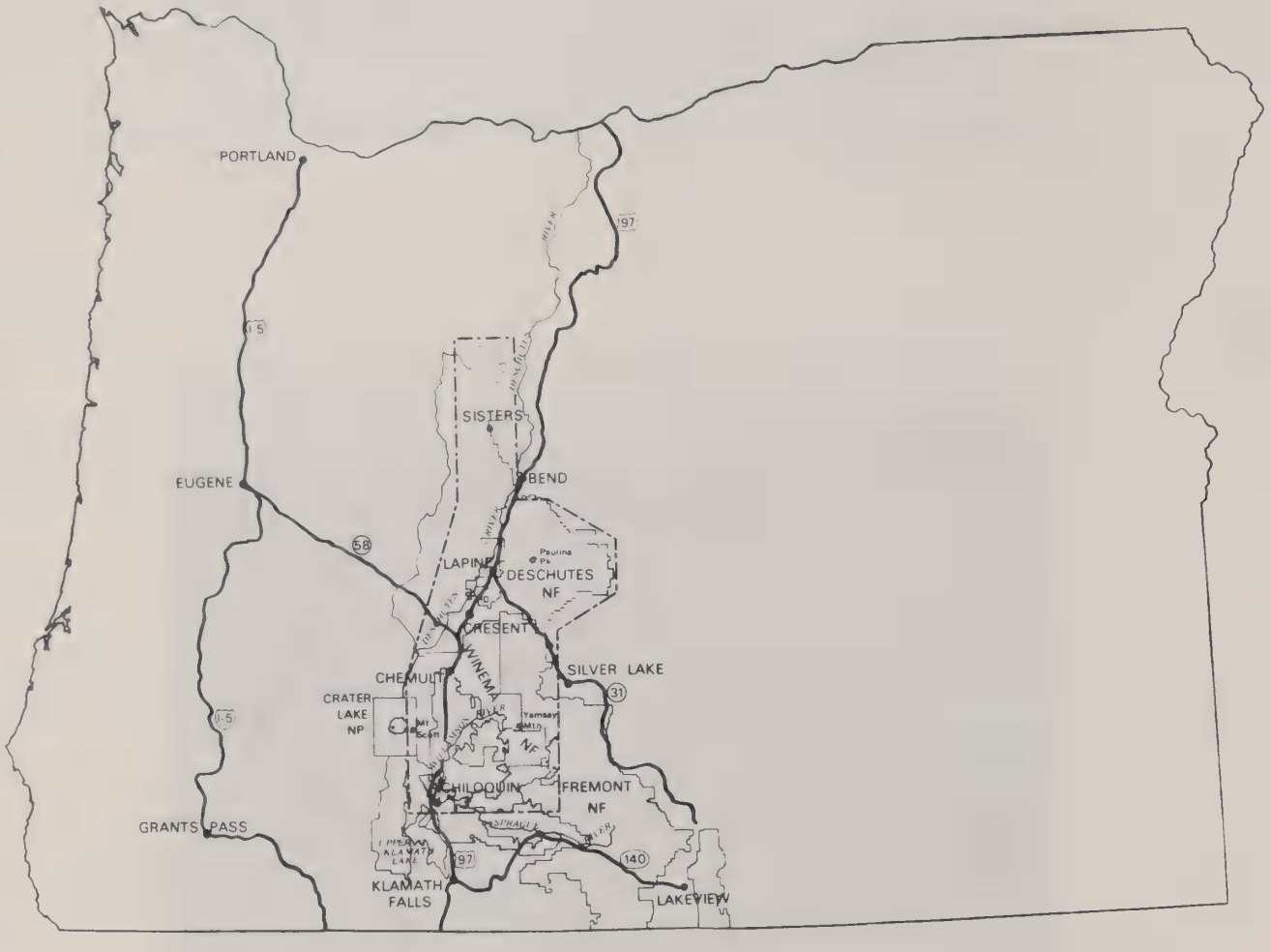


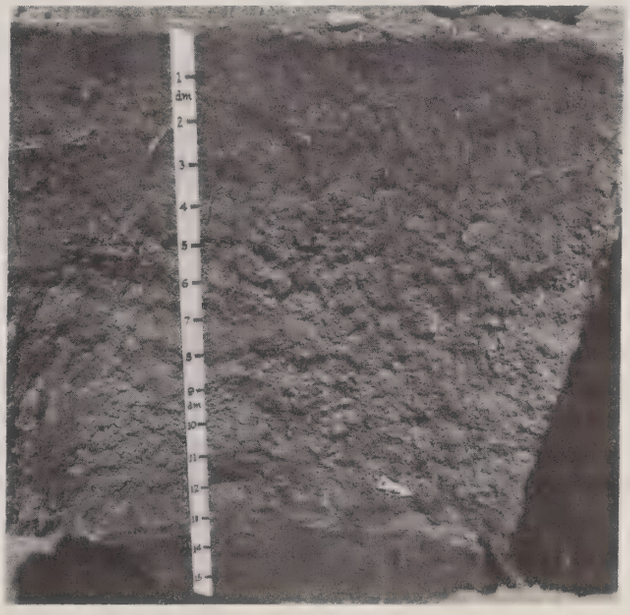
Figure 1: Map of Oregon showing major highways, towns and National Forests within central Oregon pumice deposition zone. The forage rating guides apply to the area indicated by a dashed line. Map scale is 1:3740774.

Soils developed from pumice are quite different from mineral soils. The high internal porosity of pumice material results in slow heat transfer and low heat storage within the soil profile. For this reason, pumice soils experience surface temperatures exceeding 150-170°F during mid-summer days yet plunge toward freezing at night. Seedling desiccation is a common occurrence the first growing season. Frost heaving of young plants is prevalent when moist surface soils form ice crystals during clear, cold spring or autumn nights. Often revegetation efforts with domestic species fail in coarse textured pumice because of desiccation or frost heaving.

Bulk densities for pumice soils range from .5 to .75 which means the larger particles float on water. Torrential summer thundershowers often redistribute surface soil gravels and develop rills on slopes over 20 percent gradient.

The pumice soils are difficult to compact when dry or wet except where fine particles are present in meadows or alluvial outwash. Compaction on forested sites from grazing animals is usually alleviated by frost heaving within the year it occurs. Pumice soils are easily displaced by livestock on slopes exceeding 30 percent because textures are low in clay, have a high percentage of sands and coarse fragments, and have single grain structures.

Pumice soils have weak profile development. Most often a horizon of organic accumulation (A1 horizon) lies over a parent material horizon (C) with a transitory horizon (AC) separating the two. Approximately 75 percent of soil nutrients are concentrated within the A1 and upper 4 inches of AC horizon, that is the top 6 to 7 inches of soil. These soils are generally low in nitrogen, phosphorus and sulfur. Land treatments which remove or displace these horizons will affect the growing potential of the site.



Well drained soil profile from air laid pumice of Mt. Mazama origin. AC horizon to 18 inches. Buried soil from basalt occurs at 52 inches. Profile typical of dry-tending forest vegetation.

Imperfectly drained soil profile from alluvial redeposition of air laid pumice. AC horizon to 14 inches. Water table at 38 inches. Soil typically supports meadow vegetation.

APPLICATION AND LIMITATIONS

These forage rating guides apply to the non-forest and forested rangeland within the pumice zone. Rangeland is defined as land on which native vegetation is suitable in amount and distribution for grazing and includes meadows, shrublands, and coniferous forests. Forage created as a result of clearcutting commercial forest lands cannot be evaluated with these guidelines until the mid and late seral ecological stage has been reached (see FSH 2209.2 for definition). Early ecological stages were not sampled.

Sixty-one plant associations have been described for the Central Oregon pumice zone (Volland, 1982). These guidelines apply to about one-half of the associations described. The remaining associations provide little available forage except as transitory range following timber harvest and have not been considered.

Range inventory data was collected and evaluated for significance by plant association. Whenever non-significant differences occurred in the data between two associations the data from each was consolidated to form a new population. A similar approach has been used by Hall (1971) on data from the Blue Mountains in Oregon. As a result of this analysis the plant associations were collapsed or condensed to a smaller number of "entities" which were significantly different between themselves and internally homogeneous in characterization and response to livestock management treatments.

The ten entities which emerged from the analysis and their plant association membership by ecoclass code are listed below. A forage rating guide has been written for each group.

A. Non-Forest Rangeland

1. Tufted Hairgrass Meadow (MM19)

2. Kentucky Bluegrass Meadow (MM90)

3. Cusick Bluegrass Meadow (MD19-11)

4. Sagebrush/Bunchgrass (SD19-12, SD29-12, SD29-13)

5. Sagebrush/Needlegrass (SD29-14)

B. Forested Rangeland

1. Pine/Shrub/Fescue (CPS1-11, CPS2-11, CPS2-16, CPS2-17, CPS3-14, CLS2-14, CLS1-11)

2. Pine/Shrub/Needlegrass (CLS2-13, CLS2-11, CLS2-15, CPS2-12, CPS2-13, CPS3-11, CWS1-14)

3. Pine/Shrub/Long-Stolon Sedge (CLS2-12, CPS2-14, CPS2-15, CPS3-12, CWC2-13, CWS1-15, CWS1-13)

4. Pine/Long-Stolon Sedge (CLG4-11, CPG2-12, CLG4-12)

5. Mixed Conifer/Pinegrass (CWC2-12, CDS6-14)

The plant association descriptions for the central Oregon pumice zone (Volland, 1982) are used to determine which forage rating guide is appropriate for a site being evaluated. The site is first classified as to which plant association it represents. Once the correct association is discerned, the appropriate forage rating guide can be chosen by finding the ecoclass code associated with the correct association under the forage rating guide title. Another alternative is to use the vegetation-site key given in this section as a means of determining the appropriate forage rating guideline.

The forage guidelines apply only to native vegetation impacted by mule deer cattle and sheep grazing. The guides do not include evaluation criteria for stands comprised entirely of seeded domestic species as orchardgrass, intermediate wheatgrass or smooth brome or stands affected by burning, logging or thinning which have not been grazed by domestic ungulates.

CONCEPT OF FORAGE RATING (CONDITION)

The forage rating guides provide numerical and qualitative data for evaluating livestock forage condition. The rating is based on species density and composition as well as production. Condition of livestock range is a result of livestock grazing and/or tree stocking level (on forested sites). Refer to FSH 2209.21 for a discussion of range condition and forage rating. The assumption is that a stand of vegetation in equilibrium with its environment will produce in accordance to its site potential in the absence of livestock grazing. This site potential is defined as good condition, i.e., forage condition is viewed as an effect of livestock management. In forest stands this site potential may be less in the late seral or climax ecological stages than early to mid seral stages due to tree canopy effects on light interception. Adjustments for increases in tree stocking level, as reflected in canopy cover or tree basal area, are incorporated into the guides so the effect of livestock grazing on the vegetation can be separated from effects of tree stocking.

Any detrimental influence of livestock grazing is reflected by a decline of forage condition. This decline is expressed as a change in forage rating class. The number of forage rating classes is determined by the variability in the statistical data. Narrow variation around a mean permits more classes than highly variable information. The wider the confidence interval the less forage rating classes are possible. The pumice forage data is quite variable with respect to its mean as measured by the coefficient of variation (std. dev./mean) so four forage classes are recognized: good, fair, poor and very poor. The mean value and 95% confidence interval for forage hits and composition of stands considered in good forage rating was used to determine the lower limits of good, fair, and poor. Each class is defined as follows:

Good: Available livestock forage has essentially come into dynamic equilibrium with the prevailing environment so that successional trends in the understory vegetation due to livestock grazing are not apparent. The prevailing environment may be climatically controlled or result from periodic burning or maximum tree crown closure for the site potential. Available forage is not being materially altered in structure, density or composition by livestock grazing. Changes in livestock management are not necessary.

Fair: Available livestock forage is not in equilibrium with the prevailing environment. Succession trends in the understory vegetation due to livestock grazing are apparent. The vegetation is being altered in structure, density or composition by livestock grazing so that moderate adjustments in livestock management may be considered.

Poor: Livestock forage is not in equilibrium with the prevailing environment. Succession trends in the vegetation due to livestock grazing are apparent. Usually the early or mid seral ecological stage is represented by the livestock forage compared to the rest of plant community. The vegetation is being altered in structure, density or composition by livestock grazing so that major adjustments in livestock management should be considered.

Very Poor: Livestock forage is not in equilibrium with the prevailing environment so that successional trends in the understory vegetation is apparent. Livestock forage is usually in very early to early ecological stage compared to the rest of the plant community. Forage available to livestock has been so altered in structure, density, and composition by past livestock use that improvement through livestock management alone is not feasible.

SPECIES CLASSIFICATION

Species composition is an important attribute for determining which forage rating class is appropriate for the site being evaluated. Species composition varies considerably between the classes within any rating guide. The species are classified as decreasers, increasers and invaders depending upon their palatability to livestock and response to livestock management. Palatability is the relative preference by a grazing animal for a particular species. Decreasers are the most palatable species which readily decline in density, composition and vigor with overuse by livestock. Increasers are those species which increase in either density or composition with excessive livestock use. Increasers are further subdivided into palatable and unpalatable increasers. Palatable increasers are utilized by livestock along with or in place of decreasers and tend to increase and replace decreasers, at least for a time, then decline under continued overuse. Unpalatable increasers have strong competitive ability, are not normally preferred by livestock, and will replace decreasers and palatable increasers as overuse continues. Invader species are those which are either absent or present in very small amounts in good forage rating but which are opportunistic and have the potential of dominating a site once decreaser and increaser competition is reduced. Invaders may have low forage value or be palatable during very limited periods of the year.

The forage rating of plant communities in the pumice zone is determined by the plant species which are designated decreasers and palatable increasers. These species are listed for each forage guide and apply to both cattle and sheep range. In some instances species response to mule deer use is also given. Immature pumice soils in mid seral ecological development tend to support a host of species that respond to site disturbance as increasers and to

grazing pressure as decreasers. In some cases, statistical limits are provided within the forage guide on the amount of palatable increaser composition. For instance a site can be rated down if an excessive amount of palatable increasers are present. Palatable increasers, by definition, will comprise a larger portion of forage composition in fair than either good or poor condition. Limits are imposed to rate down stands with excessively dense shrub components due to livestock grazing. The species composition of such stands is imbalanced although forage production may increase substantially.

FOREST RATING IN FORESTED STANDS

The maximum density and composition of herbaceous vegetation in forested types is based on tree crown cover. Tree cover is a function of timber management not livestock management. Forage rating is assessed according to the potential under existing timber stand conditions and not the potential natural community. A stand is not viewed as "poor" because dense, stagnated saplings prevent a "good" rating. A poor forage rating is interpreted as requiring change in livestock management to attain an upward trend -- something which is impossible under stagnated saplings. Forage cover and composition data are shown for various densities of tree crown cover or basal area. The top of each forage class reflects the best that can be produced under the prevailing tree overstory situation.

PLANT VIGOR

Vegetation vigor estimates may aid interpretation of forage rating but are very misleading unless three concepts are understood. First, maximum vigor is not attained in good forage rating. By definition, good forage condition is that stable state where decreasers are in such great competition that increaser species are held at low densities. In such a state, "vigor" is not maximum. Second, maximum vigor is usually attained in poor or fair forage rating in an upward trend. Downward trend is caused by poor to moderate vigor as results from continued overgrazing. Third, vigor is often a function of growing conditions rather than of livestock use. Criteria for maximum vigor must be established each year to account for growing conditions. Maximum forage vigor for any site can be estimated from utilization cages which are moved each grazing season.

TREND INTERPRETATION

Trend interpretation has not been included with these forage rating guides. Trend is change in vegetation on a specific site over time. It is not a calculated measurement using forage rating criteria. A forage rating is not necessary for trend interpretation. At best it can only suggest if an upward trend in the current vegetation is feasible. For instance, range in good rating should reflect little or no trend since the site is producing at its potential. Trend evaluation requires repeated vegetation sampling over a period of years supplemented with measurements of animal, climate, and land treatment impacts on the vegetation. It is designed to evaluate cause and effect relationships as a means of appraising land management.

PROPER SITE IDENTIFICATION

Site identification and correct selection of a forage rating guide are essential for sound appraisal of livestock forage. This is particularly true on ranges in poor and very poor forage rating. Poor Pine/Shrub/Fescue looks very similar to fair Pine/Shrub/Needlegrass. Management interpretations related to potential carrying capacity, the season of use, and capability to support a wooded canopy are quite different between these two guides. Fescue sites will respond to improved livestock management much more than needlegrass sites. Pine/Shrub/Fescue is a primary candidate for revegetation because the pumice soils are well mixed and maximum return on the investment is possible. The real meaning and use of forage ratings is in the management interpretations placed on them.

METHODOLOGY

The pumice zone forage rating guides are based upon sampling of vegetation that appeared to be least disturbed by livestock grazing. The intent of this sampling was to encompass as much variation in sites as possible to reflect the difference in site potential in good forage rating. Sample plots were distributed across the variability encountered within each plant association within central Oregon. Differences in soil parent material, elevation, slope steepness, slope direction and geographic location were included in the sample of each association. Under such a sampling philosophy, data tend to be variable. Data are given for each guideline which gives the sample size, the mean value and 95% confidence interval and coefficient of variation. Rarely does the confidence interval lie within $\pm$ 15% of the mean.

Data were also collected from paired plots to illustrate effects of tree crown closure and increased tree stocking level on understory attributes. A small percentage of the sample plots from each association were taken in vegetation disturbed by overgrazing. Information from these plots was used to adjust the forage class limits for a rating guide if the data indicated a curvilinear rather than linear response curve as one progressed from good to very poor forage rating.

Sampling for the forage rating guides was accomplished using the three-step method (Parker, 1951) for plant hits and closest perennial procedure for species composition (Parker, 1953). Line intercept data was taken for shrub crown cover and tree cover estimates 1/. Tree basal area was taken at

1/ Densiometer readings of tree cover were measured at three points along each loop frequency transect and were later correlated with the line intercept data. Densiometer measurements gave consistently higher values than did line intercept data on tree overstory and understory. Better regressions between plant hits or composition and tree canopy cover resulted from line intercept than densiometer data. Therefore, the densiometer approach was disgarded in favor of line intercept estimates.

the 0, 50 and 100 foot mark along each transect by using a prism count with BAF 10. Density, frequency, foliar and basal area cover estimates for the reconnaissance forage guide were taken from square foot microplots located along the same transects used for line intercept and loop frequency measurements.

Three-step plant hits are differentiated from closest perennial composition. Plant hits is an absolute measure, the number of hits being affected by the size of the loop, its shape, the number sampled and the pattern of the vegetation. Generally vegetation grows fairly sparce on pumice soils within central Oregon. As a consequence hits on decreaser and palatable increaser herbaceous plants rarely average 6-10 even in good forage rating, with the exception of meadow communities.

Closest perennial composition is a relative measure. Irrespective of the species membership, the composition always adds up to 100. Therefore the grazing quality of the species comprising forage composition must be included in an evaluation system, as well as the magnitude of their individual contributions. Decreaser shrubs were included in the composition measurement because their contribution to the annual forage supply often exceeds the herbaceous contribution, especially in those stands dominated by western needlegrass, squirreltail and Ross sedge.

One problem with rating forage composition in some plant communities is that the composition is dominated by palatable increaser grasses which usually have higher values in fair and poor forage rating than in good rating. This is opposite to decreaser plants which generally decline as the forage rating class is lowered. In the case of increaser dominated communities it appears that limits should be placed on species composition so that with their increase from disturbance they do not receive more weight than when stand is not disturbed.

Whenever a statistical relationship was apparent between forage hits or forage composition and tree canopy cover and stand basal area the point rating system was adjusted to reflect the effects. This means that forested rangelands in good forage rating will experience lower hits or composition of decreaser and palatable increasers when at higher tree cover or basal areas than under more open forested conditions. Adjustment criteria will vary between forage guides, the most obvious adjustment pertains to Pine/Shrub/Fescue and Pine/Shrub/Long-Stolon Sedge guides. Tree crown cover estimates are required for both guides to adequately reflect forage rating.

The regression equation of forage cover hits or composition to tree canopy cover or basal area can be used in two ways. First, as a way of visualizing the effects of the tree layer on understory vegetation attributes. Second, as a method of predicting the numerical value of understory vegetation attributes given measured values for tree cover or basal area. For example, Figure 2 illustrates the effect of shrub canopy closure on decreaser and palatable increaser herbaceous hits when tree canopies are less than 40% in the Pine/Shrub/Fescue forage guide. Herbaceous hits decline in a negative curvilinear fashion as shrub canopies become more dense. The forage cover rating for the guide reflects this relationship by stating different criteria for different levels of tree and shrub closure. The equation can be used as a predictor of herbaceous hits provided an estimate of tree and shrub canopy closure is available. If a discrepancy between the predicted and measured values for herbaceous hits exist, the range examiner should evaluate the reason for the discrepancy and rate forage upward or downward accordingly.

Forage production estimates are provided for each forage rating guide. The estimates are standing biomass of all herbaceous species as sampled with ten 9.6 square foot microplots in forested stands and twenty .96 square foot microplots in non-forested vegetation. Shrub production was not taken. These estimates were sampled from stands in good forage rating without the effects of tree overstory closure or excessive livestock use. A 95% confidence interval is given for each average production estimate. The forage production data is highly variable irrespective of which guideline is considered. The data was collected over a five year period; therefore, a large portion of this variability is attributed to interseasonal climatic effects. As a result of this variability little statistical relationship was found between forage production and forested stand attributes as canopy cover or basal area. Variability in the forage production data was also regressed against selected physiographic and easily measured soil attributes in an attempt to develop an equation to predict production. For most forage rating guides variability in the production data masked any meaningful correlations. As a consequence, the forage production information should be used only for broad National Forest planning purposes. Additional clipping studies under more controlled conditions are necessary to project forage production information on a range allotment basis.

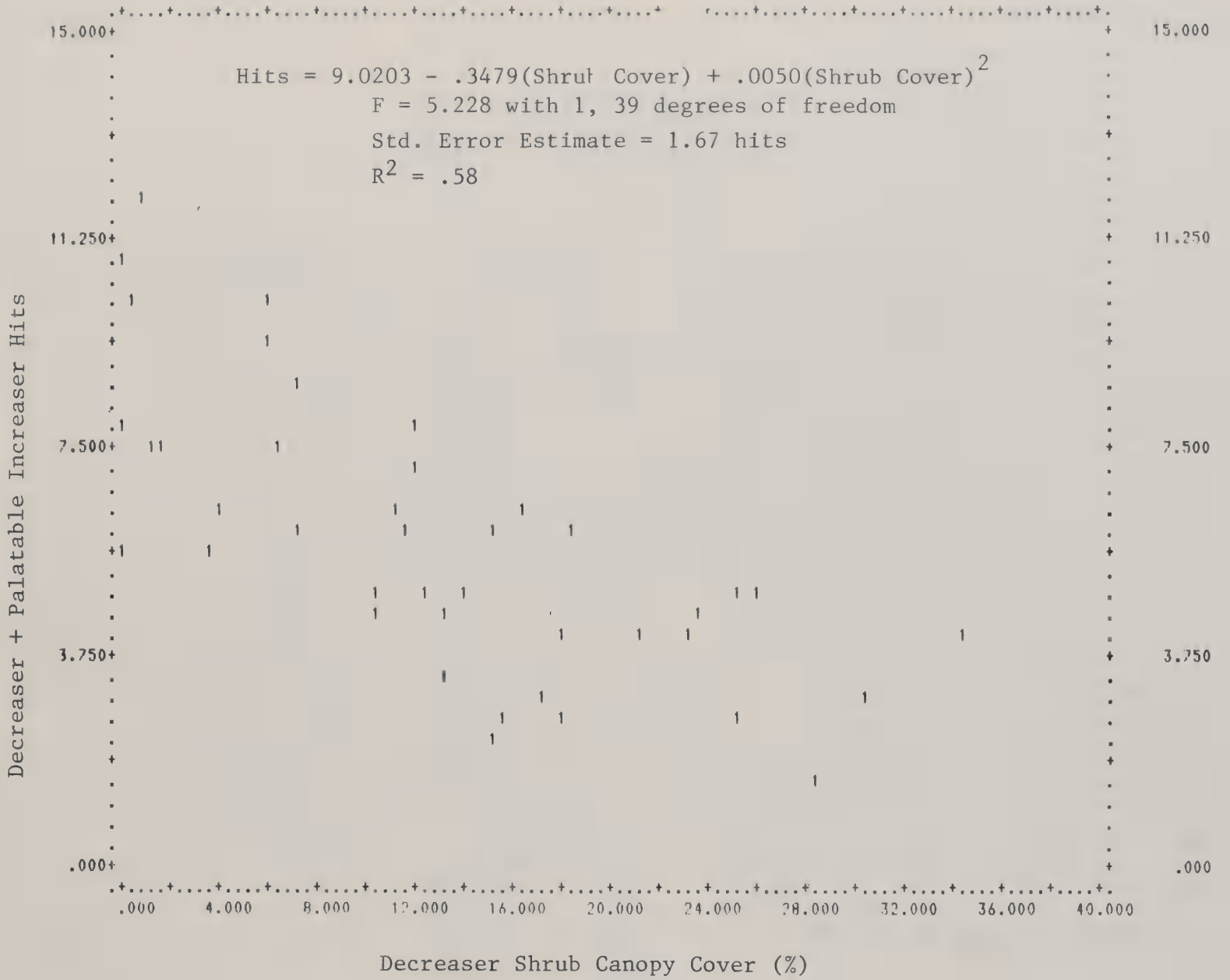


Figure 2: Effect of shrub canopy closure on decreaser and palatable increaser hits for Pine/Shrub/Fescue Forage Guide when tree canopies are less than 40 % cover.

SAMPLING INSTRUCTIONS

Use of the forage rating guides requires field estimates of plant hits and closest perennial as obtained from the three-step method or a paced transect. A plant hit is recorded when the live basal area of a herbaceous or shrubby plant occurs within the 3/4 inch loop. Directions for measuring hits on ground characteristics are given in FSH 2209.21.

Particular attention should be paid to the way closest perennial composition is sampled. The closest perennial shrub or herbaceous plant lying in an arc 90° directly upslope from a foot mark and back to the last measurement point is counted in composition. This prevents a plant from being recorded more than once in the composition score. The basal area or live root crown are used for determining the position of plants with respect to composition.

Shrubs are included in composition for two reasons:
1) a palatable shrub as common as bitterbrush carries the bulk of the forage supply and responds readily to management,
2) in some pumice communities, bitterbrush or squaw currant are the only decreasers available for evaluation.
Measurement of three-step clusters in the pumice zone will require this modification in closest perennial procedure. Not applying this procedure will significantly magnify palatable increaser composition and result in forage condition being underated.

Line intercept estimates of shrub and tree crown cover may be necessary for some forage guides. Line intercepts on staked transects are recorded to the closest tenth of a foot for any live shrub or tree canopy intersected by the line. Pace transects require a shrub or tree canopy over the sample point before being recorded as an intercept.

A rough estimate of forage rating can be obtained by ocularly estimating density, frequencies of foliar cover of selected indicator species. The estimates are taken from ten randomly placed 9.6 square foot circular plots in forested or non-forest shrubland communities or twenty .96 square foot circular plots in meadow communities. The sampling results are compared to the criteria given in the reconnaissance forage guide.

RATING PROCEDURES

These guides are designed to estimate a forage rating for a particular site using data collected in one of two ways. The three-step method can be employed along permanent transects or a pace method for temporary transects. Another alternative is a reconnaissance method in which selected attributes are estimated from microplots placed along a transect.

Forage rating is comprised of three parts which, in aggregate, can total to 100 points:

Forage cover hits	25 points
Forage composition	65 points
Plant vigor	10 points

This type of rating system is only appropriate using the three-step method. The total point score for a site determines its estimated forage rating class. The point limits by class are as follows:

Good	76 - 100 points
Fair	51 - 75
Poor	26 - 50
Very poor	0 - 25

Soil stability is evaluated using the amount of ground surface exposed and evidence of current soil erosion. The ground surface exposure rating receives a maximum of 50 points and is based upon the number of bare soil plus pumice pavement hits along established transects. The amount of exposed ground surface acceptable in a good rating varies considerably between forage guides. Current soil erosion is also given a maximum of 50 points and is based upon a subjective determination by the range examiner as to which of five qualitative descriptions fits the site in question. An aggregation of exposed ground surface points and current erosion points is applied to the same four class rating system used for rating forage.

The reconnaissance method involves an estimate of the average foliar cover, density and frequency of specified plants. Forage rating is based on this estimated average as compared to a defined range of values given for each of four classes (Good, Fair, Poor and Very Poor). Estimates of ground surface exposed (or amount of litter) are used to rate soil stability. The current erosion descriptions are also used with the 50 point scale adjusted to a four class system: Good 38-50, Fair 26-37, Poor 13-25, and Very Poor 0-12.

Forage production estimates are given for each guide. However, no attempt has been made to rate condition classes based upon variability of production found in stands rated as good. The experienced variability associated with a calculated production average makes any rating criteria worthless within the pumice zone.

Vegetation Site Key to Forage Rating Guides

(Central Oregon Pumice Zone)

1. Site dominated by non-forest vegetation. Vegetation aspect is either shrubland or grassland. Trees may be present but not impacting understory vegetation.

    2. Site dominated by meadow vegetation. Lodgepole pine can be present. Water table within 48 inches of soil surface during spring months.

        3. Site dominated by bunchgrass vegetation. Rhizomatous species as dense, localized colonies.

            4. Tufted hairgrass present.
            Tufted Hairgrass Meadow p. 19

            4. Tufted hairgrass absent.
            Cusick Bluegrass Meadow p. 58

        3. Bunchgrass vegetation very subordinate to rhizomatous grasses and perennial forbs
        Kentucky Bluegrass Meadow p. 40

    2. Meadow vegetation absent. Sagebrush, bitterbrush, rabbitbrush prevalent with occasional western juniper or ponderosa pine. Water table absent throughout the year.

        5. Idaho fescue present. Soil derived from Mt. Mazama dacite pumice.
        Sagebrush/Bunchgrass p. 72

        5. Idaho fescue absent. Soil derived from Newberry rhyolite pumice.
        Sagebrush/Needlegrass p. 95

1. Site presently characterized by forest vegetation or evidence of past tree dominance is evident.

    6. Bunchgrasses predominate the herbaceous layer.

        7. Idaho fescue present.

            8. Long-stolon sedge present.
            Pine/Long-stolon sedge p. 164

            8. Long-stolon sedge absent.
            Pine/Shrub/Fescue p. 108

        7. Idaho fescue absent.
        Pine/Shrub/Needlegrass p. 127

6. Rhizomatous sodformers predominate the herbaceous layer.

9. Shrub layer present or past shrub dominance evident.

10. Pinegrass present.
Mixed conifer/Pinegrass p. 178

10. Pinegrass absent.

11. Bitterbrush and/or snowbrush dominate in shrub layer.
Pine/Shrub/Long-stolon sedge p. 145

11. Neither bitterbrush or snowbrush present shrub layer.
Pine/Long-stolon sedge p. 164

9. No evidence of a shrub layer.

11. Long-stolon sedge present and at least codominant with other species.
Pine/Long-stolon sedge p. 164

11. Long-stolon sedge absent or very subordinate to other species.

12. Pinegrass present.
Mixed conifer/Pinegrass p. 178

12. Pinegrass absent.
Kentucky Bluegrass Meadow p. 40

FORAGE GUIDE SUMMARY FOR CENTRAL OREGON PUMICE ZONE

Forage Guide	Decreaser plus Palatable Increaser Hits	Comp	ft^2 Cover	ft^2 Density	ft^2 Freq	Hits Soil +Pav.	Herb Prod	Sample Size
Hairgrass (xeric)	9	44	30	3.0	75	6	2035	5
Hairgrass (meric)	30	81	30	3.0	75	6	2035	5
Kentucky bluegrass	21	75	2	-	27	6	1835	5
Cusicks bluegrass	18	68	24	2.2	75	16	2300	5
Sagebrush/ bunchgrass	9	70	16	2.9	69	39	290	24
Sagebrush/ needlegrass	6	70	5	1.5	61	71	150	5
Pine/shrub/ fescue*	20	81	15	6.0	60	9	174	42
Pine/shrub/ needlegrass*	15	81	5	.8	36	12	12	55
Pine/shrub/ sedge*	35	81	5	.7	31	6	56	20
Pine/sedge*	9	80	5	.7	31	9	220	8
Mixed conifer/ pinegrass*	12	81	.9**	1.1	26	5	225	13

* based on minimum tree cover per type.

** basal area rather than foliar cover.

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Forage Rating Guide
for
TUFTED HAIRGRASS MEADOW
(Ecoclass: MM19)

VEGETATION DESCRIPTION

This forage rating guide applies to those non-forest meadows characterized by tufted hairgrass. Tufted hairgrass within the pumice deposition zone of central Oregon holds an intermediary ecological position which is more mesic than Kentucky bluegrass meadows and more xeric than sedge-rush meadows. As a consequence of this continuum, meadows dominated by tufted hairgrass may support either a strong grass-forb component on the more xeric portion or a strong sedge-rush component on more mesic sites. These components or sites are the result of inherent variability in the physical environment and not a result of past livestock grazing. Livestock grazing will confound the vegetative differences between the two sites, but even in poor forage rating they can be recognized as different. Both tufted hairgrass meadows are described within the guide with separate statistical information provided for each.

Tufted hairgrass meadow on dry end of moisture continuum in good forage rating. Herbaceous production is 2600 lb/acre dry weight.

Tufted hairgrass meadow on moist end of continuum in good forage rating. Herbaceous production is 3200 lb/acre dry weight.

These meadows contain a great variety of grasses, sedges and forbs. Species diversity is higher in the xeric grass-forb phase than the more mesic sedge-rush phase. Kentucky bluegrass may become a weak codominant with tufted hairgrass as result of overgrazing in the grass-forb phase but will never completely dominate the stand as is typical of more xeric environments. Grasses as Oregon bentgrass, thin bentgrass, bluejoint reedgrass, northern reedgrass, meadow barley, slender wheatgrass, California oatgrass and junegrass usually are found but not in abundance. Sedges as analogue sedge, Nebraska sedge, slenderbeak sedge and slenderbog sedge along with the rushes as Baltic rush, Mertens rush, Colorado rush and Nevada rush are usually as common as the graminoids. Common forbs of the grass-forb phase are penstemon, cinquefoil, longstalk clover, western aster, and buttercup. The most common forbs in mesic situations are orange arnica, buttercup and western aster.

The most palatable species are tufted hairgrass, Nebraska sedge and Kentucky bluegrass. These meadows are preferred as mid to late summer forage by cattle after more xeric bluegrass meadows are grazed. Consequently, they usually receive light to moderate use. Grazing is rarely season-long so examples of tufted hairgrass meadows in poor or very poor forage rating are not common. Overgrazed meadows revert to a predominance of perennial forbs, Baltic rush and pullup muhly. Colonies of silverweed and orange arnica, may

be evident. Tufted hairgrass meadows are also found in environments which are conducive to rapid vegetative recovery. For the same degree of grazing use they respond in plant vigor and species composition much more readily than either moist or dry bluegrass meadows.

Tufted hairgrass - Nebraska sedge meadow in fair condition showing pedestalling of hairgrass as result of early summer cattle grazing when soil is wet.

Physiologically the bunchgrasses respond quite differently to grazing than rhizomatous grasses. Carbohydrates are stored primarily in the roots and root crowns of bunchgrasses and in roots and rhizomes of sodformers. Bunchgrasses reproduce only from seed while sodformers reproduce from both seed and vegetative organs. Consequently sustained close grazing by livestock on bunchgrasses will reduce their reproductive potential through reduced seed head production. Sustained close grazing also lowers the vigor of bunchgrasses by depleting carbohydrate reserves. A reduction in vigor is indicated by a decline in root length, basal area and leaf length. Eventually the competitive ability of these grasses decreases and stand composition shifts to less preferred species. Close herbivore utilization on some rhizomatous species (Kentucky bluegrass as an example) affects tiller density and leaf length. The growth form changes with continued over utilization so a greater portion of the plant is unavailable for grazing. The reproductive potential of these sodformers is maintained by a shift from seed to rhizomatous regeneration.

These meadows will support willows especially along perennial streams and periphery of wetter meadows. Protection from livestock grazing and control of underburning increases the invasion of lodgepole pine onto tufted hairgrass meadows, although density of the trees is not what can occur in Kentucky bluegrass meadows. Seldom does lodgepole pine stocking exceed 25 trees per acre. The drier sites are more receptive to tree invasion than mesic sites.

Species composition and dominance is very sensitive to fluctuations in the water table. Lowering the water table through channel cutting, poor road location or drought will change site potential and favor the expansion of Kentucky bluegrass and perennial forbs. Raised water tables favor sedges and rush dominance.

Nothing is known about the effect of periodic underburning on these meadows. Generally repeated burning will favor rhizomatous species over the bunchgrass as tufted hairgrass, slender wheatgrass and Williams needlegrass. Close coordination between season of burning and grazing management is necessary to prevent utilization of bunchgrasses twice in the same growing season.

SITE DESCRIPTION

The forage rating guide is restricted to the pumice deposition zone of the Deschutes, Fremont and Winema National Forests. These meadows occur on flat to concave microrelief of basins, drainages and flats. Slopes are 0 to 1%. Stands are associated with Kentucky bluegrass meadows of more elevated xeric positions and wet sedge-rush meadows downslope. Occasionally local physiography permits tufted hairgrass meadows to occur adjacent to stands of lodgepole pine.

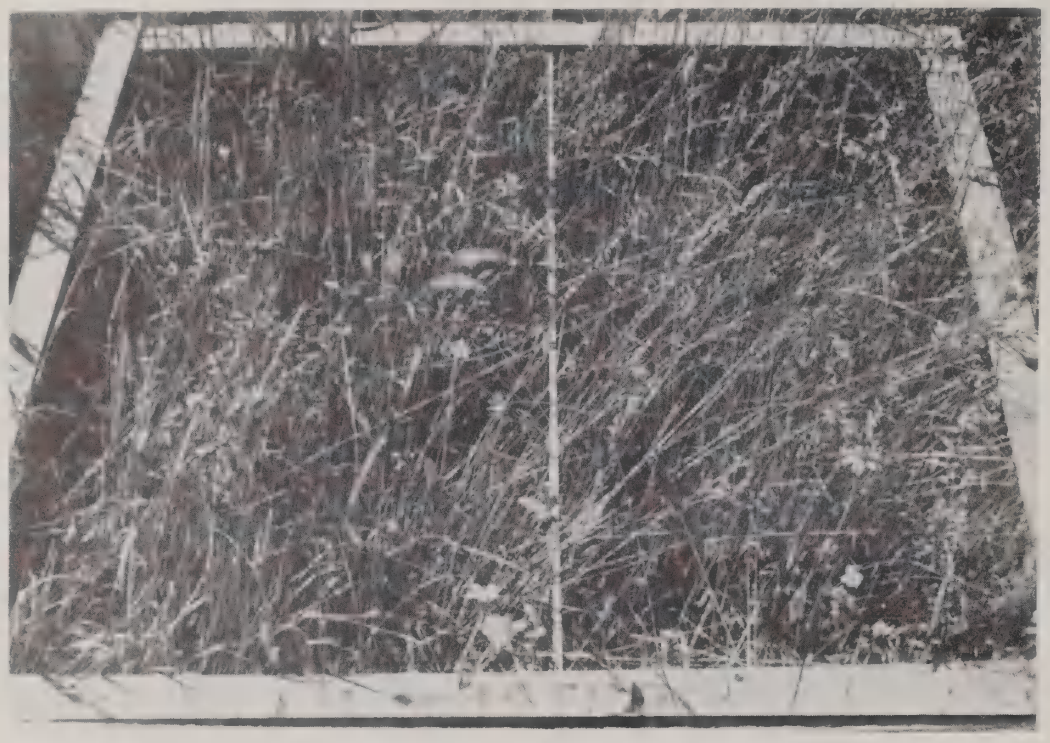
Soils are derived from shallow to deep pumice alluvium overlying basalt or andesite alluvium, tuft, or outwash sand. The buried soil is usually less than 6 feet below the soil surface. Soil profiles have loamy coarse sand to silt loam surface textures grading into a well mixed AC horizon lying directly over a coarse pumice layer. A water table is within 45 inches of the soil surface throughout the growing season. Livestock grazing in late spring and early summer may result in severe soil displacement and pedestalling of bunchgrass clumps due to wet soils.

Alluvial air-laid pumice soil typical of tufted hairgrass meadows. Water table is at 26 inch depth on August 1. Notice silt loam surface texture to 6 inch depth.

FORAGE RATING

Forage rating is based upon 1) forage cover, 2) forage composition and 3) plant vigor. A qualitative description for each of four classes follows. These descriptions generally apply to the ecological status of tufted hairgrass meadows where late seral is similar to good, mid seral to fair, early seral to poor and very early seral to very poor.

Good: Tufted hairgrass is stand dominant or codominant with bluejoint or northern reedgrass, slender bog sedge, Nebraska sedge, analogue sedge or chamisso sedge. Thin bentgrass, pullup muhly, mat muhly and Kentucky bluegrass usually absent or very subordinate in both the more mesic sedge-rush phase and xeric grass-forb phase. Baltic rush subordinate and not strongly aggregated into colonies except in depressional microrelief. Orange arnica and plantainleaf buttercup usually restricted to, but subordinate in the mesic phase. Xeric grass-forb phase has rich composition of perennial forbs as western aster, longstalk clover, western buttercup, Oregon globemallow and false dandilion. These forbs are strong subordinates to tufted hairgrass. Litter layer thick and not compacted. Annual forbs restricted to recent disturbance.

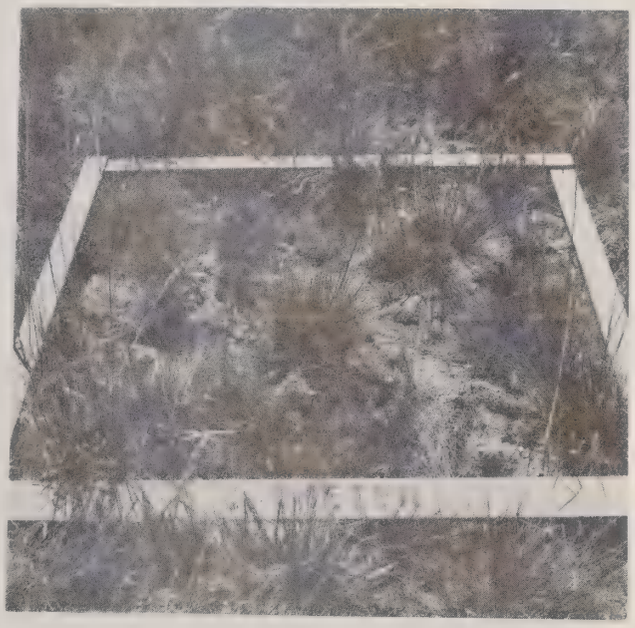


Closeup of tufted hairgrass meadow, mesic sedge-rush phase in good forage rating. Note low composition of perennial forbs. Herbaceous production about 2500 lbs./acre dry weight.

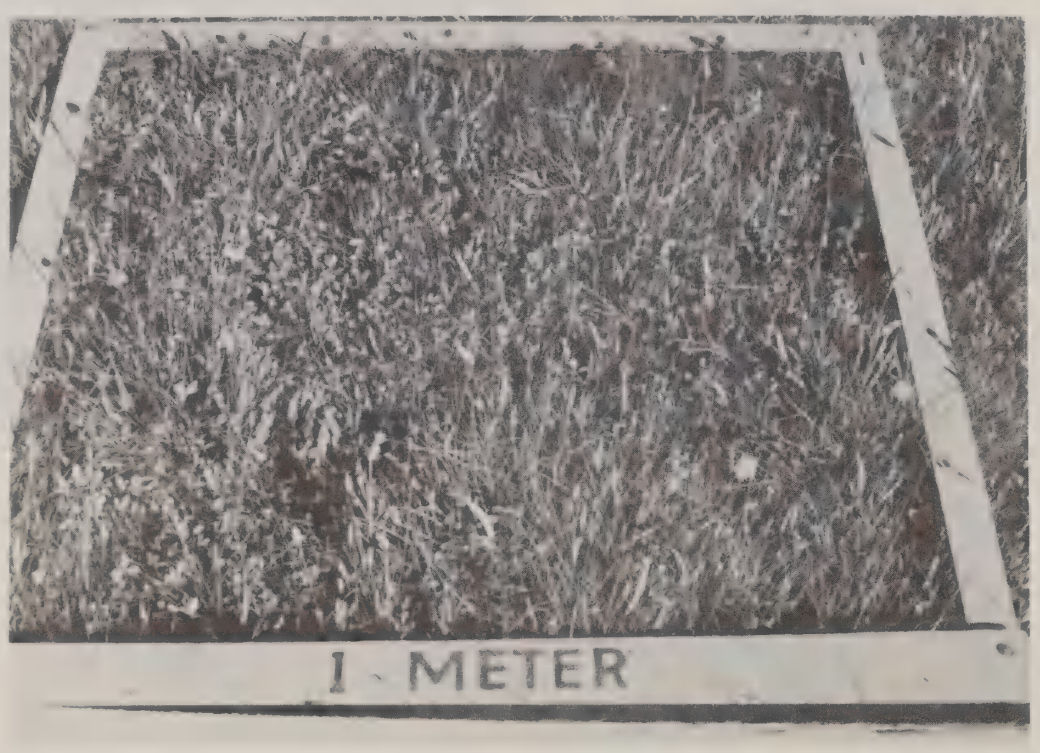
Fair: Tufted hairgrass codominant with slenderbog sedge, northern reedgrass, mat muhly, Baltic rush and Kentucky bluegrass. Thin bentgrass, Nebraska sedge, analogue sedge, Nevada rush and chamisso sedge are subordinate on mesic sites and somewhat aggregated in their distribution. Prairie junegrass and California oatgrass occur as subordinates on xeric sites. Forb component represented by a variety of species as strawberry, pussytoes, western aster, long-stalk clover, Oregon globemallow, false dandelion, buttercup, and cinquefoil. Perennial forbs may be as common as the graminoids and sedges on more xeric sites. Orange arnica, silverweed and pullup muhly strongly aggregated in distribution than more disturbed microsites.

Tufted hairgrass meadow in fair forage rating. Note reduced vigor of hairgrass. Many interspaces occupied by perennial forbs or as bareground. Herbaceous production is 2000 lb/acre dry weight. Bare soil averages 5%.

Closeup of tufted hairgrass in fair forage rating showing pocket gopher disturbance. These openings eventually become dominated by perennial forbs.



Tufted hairgrass meadow moist phase in fair forage rating. Meadow receives early season sheep grazing most years. Herbaceous production is 1200 lb/acre dry weight.

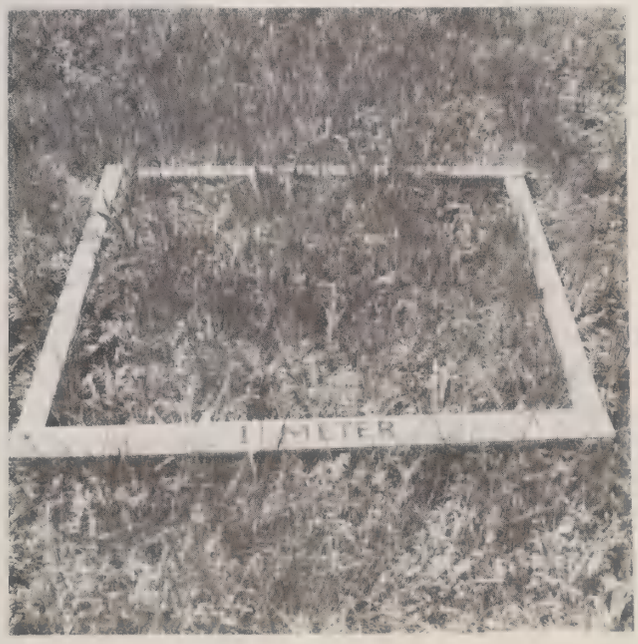


Closeup of tufted hairgrass meadow from previous photo showing reduced vigor of hairgrass and prominence of perennial forbs throughout bunchgrass interspaces.

Poor: Stand usually dominated by thin bentgrass, Baltic rush, mat muhly, slenderbog sedge, Kentucky bluegrass, pullup muhly and California oatgrass. Tufted hairgrass usually subordinate to these species. The more xeric phase has a preponderance of perennial forbs as longstalk clover and western aster which occur as large colonies. The more mesic phase becomes dominated by orange arnica and silverweed colonies. Bareground usually increases due to thinning of litter layer and increase of rodent activity. Channel cutting and associated water table lowering can result in this condition as well as excessive livestock utilization.

Tufted hairgrass meadow, moist phase in poor forage rating showing low hairgrass vigor and prominence of orange arnica. Herbaceous production is 1500 lb/acre dry weight.

Closeup of tufted hairgrass meadow from previous photo showing silverweed and orange arnica dominance. Bare soil averages 20%. Season-long cattle grazing has resulted in this condition.



Tufted hairgrass, dry phase in poor forage rating. Meadow being devastated by rodent activity. Herbaceous production averages 1400 lb/acre dry weight. Bare soil and pavement is 25%.

Closeup of previous meadow photo showing amount of ground disturbance and vigor of hairgrass. Clover, aster, and yarrow are common.

Very Poor: Tufted hairgrass subordinate to dense colonies of baltic rush & mat muhly. Kentucky bluegrass may be present but as localized colonies strongly contaminated with rush and mat muhly. Pullup muhly, orange arnica and silverweed common on mesic sites. Perennial forbs common, usually dominant over grasses. Xeric phase to chickweed, western aster and silverweed. Forbs as western yarrow, strawberry, pussytoes, buttercup and cinquefoil scarce. False dandelion and Oregon globemallow absent. Bareground predominates; litter layer discontinous and compacted. Channel cutting alone does not contribute to this vegetative rating. This forage rating usually influenced by livestock grazing.

Tufted hairgrass meadow in very poor forage rating. Continued early spring cattle use when soils are wet led to this condition. Pedestals are common. Tufted hairgrass remnants scattered. Forbs as isolated colonies. Invasion of silver sagebrush is evident. Herb production is about 300 lb/acre dry weight. Bare soil averages 45%.

FORAGE COVER RATING

The use of the three-step method in the mesic and xeric phases of tufted hairgrass meadows varies considerably in the number of direct hits on herbaceous plants per 100 feet of loop frequency transect in good forage rating. For this reason different guidelines are given for each vegetative phase.

A maximum of 25 points is assigned to forage cover. The following table lists the point rating by the number of herbaceous decreaser and palatable increaser plant hits averaged for a cluster of two or more transects.

Number of hits on Tufted hairgrass		
Mesic site sedge-rush	Grass-forb xeric site	Point Rating
9+	30+	20-25
6-8	20-29	13-19
3-5	10-19	6-12
0-2	0-9	0-5

Direct hits on herbaceous plants is considerably higher in the grass-forb site compared to sedge-rush site. The grass-forb site contains a greater variety of species, more species classed as palatable, and more stems/unit area. The grass-forb site is more preferred by livestock than the mesic sedge-rush site. As a consequence the grass-forb site is more responsive to grazing management and will better reflect the effects of forage utilization on the plant community.

FORAGE COMPOSITION RATING

A maximum of 65 points is assigned to forage composition. Forage composition rating is calculated in the following manner. Assign one point for each percent composition of herbaceous decreasers and palatable increasers. Disregard any palatable increaser forb composition in excess of 10% when on mesic site and 20% on xeric site. Disregard any palatable increaser grass composition in excess of 15% on mesic site and 25% on xeric site.

Add the resulting palatable increaser composition to the decreaser composition. The minimum acceptable decreaser composition is 25%. When decreaser composition is below 25% subtract the difference between estimated decreaser composition and 25% from the total calculated composition value. This procedure discriminates against those stands dominated by a high percentage of unpalatable increasers or invaders. The resulting score is used to rate forage composition by entering the following table.

Calculated Composition Points		
Mesic site sedge-rush	Xeric site grass-forb	Composition Rating
44+	81+	52-65
33-43	61-80	40-51
22-32	41-60	27-39
11-21	21-40	14-26
0-10	0-20	0-13

Maximum Limits:		
Pal. Inc. grass:	15%	25%
Pal. Inc. forbs:	10%	20%

PLANT VIGOR RATING

Plant vigor responds to annual weather patterns and grazing use. Bunchgrass vigor should be based upon the vigor of tufted hairgrass. The vigor of this species is very sensitive to changes in grazing management and site capability. Therefore, site potential must be determined each year from recently installed utilization cages which have not received livestock use the current season. The following guide is used to rate plant vigor that results from livestock grazing on a 10 point scale.

Description	Rating
Rhizomatous grasses with tiller-dominated top growth; stems dense and much elongated with respect to leaves. Average maximum leaf or seed stalk length of mature tufted hairgrass plants exceeds 75% of potential for the site in the year sampled. Over 30% of plants are seedlings or immature individuals, decadence rare. This vigor exists on previously deteriorated meadows which have received several years of light or late season use and now show maximum upward trend	9 - 10

Description	Rating
Mortality of mature tufted hairgrass plants occasionally evident within some basal clumps. Root crowns intact, firmly rooted and show few signs of weakness. Rhizomatous grasses with tiller-dominated top growth; stems not dense but much elongated with respect to leaves. Average maximum leaf or seed stalk length of tufted hairgrass between 51% and 75% of potential for the site in the year sampled. Less than a quarter of plants are seedlings or immature individuals. Seedling decadence occasional. This vigor exists on previously deteriorated meadows which have received an extended period of rest, now are lightly to moderately grazed with slight upward	6 - 7 - 8
Mortality of mature tufted hairgrass plants evident within many clumps. Root crowns displaced with some effort, occasional pedestaling. Rhizomatous grasses with rhizome-dominated top growth; leaves much dominant over stem growth. Average maximum leaf or seed stalk length of tufted hairgrass between 26% and 50% of potential for the site in the year sampled. Seedling or immature individuals less than 10% to 15% of plants present. Seedling decadence common. This vigor exists on poor range with little or no uptrend or those in better condition which have received early season use over extended periods of time	3 - 4 - 5
Internal portions of mature tufted hairgrass plants show much mortality. Root crowns usually pedestaled or weak and easily displaced. Rhizomatous grasses with rhizome-dominated top growth; stems very sparse as compared to leaf production. Average maximum leaf or seed stalk length of tufted hairgrass less than 25% of potential for the site in the year sampled. Seedling or immature individuals not evident or very occasional. This vigor exists on deteriorated meadows which receive continued overuse, trend is static to downward	0 - 2

FORAGE PRODUCTION

Herbaceous production averages 2450 pounds per acre air dry weight ± 300 lbs in mesic sites and 1800 pounds per acre dry weight ± 225 lbs in the xeric sites for stands in fair and better forage rating. The experienced range in data is 1400 to 3250 pounds depending upon site quality, past grazing history and yearly climatic variations. Stands in poor forage rating produce about half of those in fair to good rating.

SOIL STABILITY RATING

Soil stability is evaluated using two criteria, the amount of ground surface exposed and evidence of current soil erosion. Both criteria receive an equal weight of 50.

Bare Soil Index

The bare soil index is based on the number of transect hits on bare soil plus pavement, that is, all surface fragments less than 3/4 inch in diameter. Particle size distribution in pumice parent material makes it very difficult to separate bare soil coarse fragments from pavement sized fragments which result from accelerated erosion. Transect hits are averaged for a cluster. Bare soil rating is scored by the following table which is adjusted for central Oregon meadow situations.

Bare Soil + Pavement Hits	Index
Less than 6	45-50
10-6	35-44
20-11	25-34
30-21	15-24
Greater than 30	0-14

Current Soil Erosion Index

The following criteria incorporate natural erosion as well as erosion that is induced by grazing activities:

Description	Rating
No evidence of soil movement. Bare spaces small and well dispersed, not interconnected. Interspaces between bunchgrasses occupied by young perennial forbs and grasses or litter. Rhizomatous species form continuous sod. Litter layer usually continuous and exceeds 1.5 inches thick. Pedestalling of perennials from frost heaving and not soil movement. Soil surface friable and porous, not compacted. Trampling displacement not evident. Soil deposition from animal burrows and not water or air movement	41 - 50

Description	Rating
Soil movement slight and local. Bare spaces discontinuous and isolated, usually restricted to areas of rodent activity. Erosion confined to individual bare spaces. Larger interspaces being invaded by perennials. Litter layer thin but not appreciably compacted. Plant pedestalling from frost heaving, not soil erosion or trampling. Soil surface usually porous and friable, being compacted only in interspaces or localized areas. Little evidence of trampling displacement	31 - 40
Soil movement moderate. Bare spaces small but locally continuous and interconnected. Interspaces between bunchgrasses partially occupied by young perennials or litter. Rhizomatous plants occur as large colonies or dense mats, sod not continuous. Litter layer thin and compacted, rarely acheiving 1 inch thickness. Plant pedestals due to soil movement or grazing. Pulling up of young perennials during grazing. Soil surface with hummocks and depressions. Current soil movement occurs in bare soil openings and rodent colonies	21 - 30
Soil movement advanced. Bare soil dominates but site still influenced by vegetation and litter. Large bare soil interspaces between perennials are dominated by annuals and younger perennial plants. Sod from rhizomatous species is locally dense but aggregated and discontinuous. Litter layer very thin, highly compacted and lacking in many interspaces. Pedestals common from partial loss of A1 surface soil horizon. Trampling displacement common on wetter sites. Current soil movement not appreciably affected by vegetation or litter cover	11 - 20
Soil movement severe. Bare soil continuous and forms the matrix within which colonies of perennials are growing. Interspaces between perennial plants lack vegetation or dominated by annuals. Rhizomatous species occur as very localized, depauperate colonies. Litter layer either absent or confined to immediate vicinity of perennial plants and obstructions. Plant pedestals common. Overland movement of soil evident, from either air or water erosion	0 - 10

RECONNAISSANCE FORAGE AND SOIL RATING

The forage and soil rating of tufted hairgrass meadows can be approximated by systematically placing 20 to 30 one square foot square or .96 square foot circular plots and ocular estimating the following attributes:

a. The average foliar cover of tufted hairgrass.

b. The average number (density) of tufted hairgrass.

c. The frequency of tufted hairgrass.

d. The average percentage of litter.

All attributes should be estimated in order to correctly place a stand into a rating class. In many instances litter values may be high but a much lower frequency or cover value for tufted hairgrass will indicate a lower rating. The criteria are as follows:

Rating Class	Tufted hairgrass % Cover	Density	Frequency	% Litter
Good	> 30%	3.0 +	> 75%	80-100%
Fair	21-30	2.0-2.9	51-75	65-79
Poor	11-20	1.0-1.9	26-50	51-64
Very Poor	0-10	0-.9	0-25	0-50

SPECIES LIST

Decreasers

Agor	Agrostis oregonensis
Agtr	Agropyron trachycaulum
Caca	Calamagrostis canadensis robusta
Cain	Calamagrostis inexpansa
Dain	Danthonia intermedia
Deca	Deschampsia caespitosa
Feru	Festuca rubra
Hobr	Hordeum brachyantherum
Kocr	Koleria cristata
Stwi	Stipa williamsii
Aggl	Agoseris glauca
Mial	Microseris alpestris
Lotr	Lomatium triternatum
Pery	Penstemon rydbergii
Sior	Sidalcea oregana

Increasers, Palatable

Agdi	Agrostis diegoensis
Caat	Carex athrostachya
Cane	Carex nebraskensis
Daca	Danthonia californica
Popr	Poa pratensis
Asoc	Aster occidentalis
Pogr	Potentilla gracilis
Raal	Ranunculus alismaefolius
Raoc	Ranunculus occidentalis
Taof	Taraxacum officinale
Trlo	Trifolium longipes

Increasers, Unpalatable

Cala	Carex lasiocarpa
Casi	Carex simulata
Juba	Juncus balticus
Juco	Juncus confusus
Jume	Juncus mertensianus
June	Juncus nevadensis
Muri	Muhlenbergia richardsonis
Acmi	Achillea millefolium
Arfu	Arnica fulgens
Anco	Antennaria corymbosa
Asca	Aster canescens
Frvi	Fragaria virginiana
Poan4	Potentilla anserina
Soca	Solidago canadensis

Invaders

Ann	Annual Forbs and Grasses

SUMMARY STATISTICS OF THREE-STEP DATA (Sedge-Rush Mesic Sites) 1/

	Mean	95% CI	CV	N
Decreaser + Palatable Increaser Hits	10.0	2.26	.25	5
Decreaser Hits	7.1	2.78	.44	5
Palatable Increaser Hits	3.6	1.85	.52	5
Decreaser + Palatable Increaser Comp.	35.9	13.03	.41	5
Decreaser Composition	24.2	11.55	.54	5
Palatable Increaser Composition	11.6	5.42	.53	5
Total Hits (all plants)	28.2	7.96	.32	5
Species with 80% Presence:				
Deschampsia caespitosa				
hits	5.9	3.72	.72	5
composition	17.4	9.72	.64	5
Juncus balticus				
hits	4.7	3.11	.76	5
composition	24.2	16.92	.80	5
Litter	56.4	13.63	.28	5
Moss	12.9	17.15	1.36	5

1/ Based on least disturbed stands. 95% CI: 19 out of 20 samples lie between ± stated confidence interval assuming a normal distribution. CV = coefficient of variation = std. deviation/mean. N = sample size.

SUMMARY STATISTICS OF THREE-STEP DATA (Grass-Forb Xeric Sites) 1/

	Mean	95% CI	CV	N
Decreaser + Palatable Increaser Hits	33.3	6.41	.22	5
Decreaser Hits	20.5	4.33	.24	5
Palatable Increaser Hits	12.8	3.62	.32	5
Decreaser + Palatable Increaser Comp.	70.3	11.70	.19	5
Decreaser Composition	35.2	8.77	.28	5
Palatable Increaser Composition	35.1	4.33	.14	5
Total Hits (all plants)	45.4	9.07	.23	5
Species with 80% Presence:				
Deschampsia caespitosa				
hits	17.3	5.72	.38	5
composition	26.7	8.94	.38	5
Carex lasiocarpa				
composition	3.1	2.34	.76	4
Juncus balticus				
composition	2.4	1.01	.43	4
Trifolium longipes				
composition	11.1	7.26	.66	4
Aster occidentalis				
composition	9.2	5.14	.64	5
Litter	39.6	13.56	.39	5
Moss	15.1	16.76	1.13	5
Bare soil + Pavement	4.8	1.72	.32	5

1/ Based on least disturbed stands. 95% CI: 19 out of 20 samples lie between ± stated confidence interval assuming a normal distribution. CV = coefficient of variation = std. deviation/mean. N = sample size.

SUMMARY STATISTICS, RECONNAISSANCE RATING GUIDE
(1 sq. ft. Square or Circular Plot)

Attribute	Mean	95% CI	CV	N
Litter cover	91.8	3.9	.06	10
Moss cover	6.1	4.4	1.08	9
Bare soil + Pavement cover	3.1	2.3	1.02	7
Deschampsia caespitosa				
density	2.5	.8	.53	10
frequency	92.5	6.0	.09	9
foliar cover	34.7	6.4	.28	9
Juncus balticus				
frequency	30.4	18.4	.62	9

Forage Rating Guide
for
KENTUCKY BLUEGRASS MEADOW

(Ecoclass: MM90)

VEGETATION DESCRIPTION

This guide applies to those non-forest meadows characterized by Kentucky bluegrass. Past livestock grazing practices have reduced the competitive ability of native species so that Kentucky bluegrass, an introduced sodformer, became the dominant graminoid. Bluegrass is now considered naturalized and well adapted to those sites which are characterized by a seasonally high water table and mid-summer drought. Evidence suggests these sites were originally dominated by tufted hairgrass and several sedge species. Replacement of Kentucky bluegrass, with tufted hairgrass, a perennial bunchgrass, does not appear practical under any grazing management regime including complete rest. Therefore, the guide is written with the assumption that Kentucky bluegrass will continue to remain dominant in good forage rating.

Kentucky bluegrass has the ability to produce aerial shoots from either rhizomes or tillers and significantly changes its stature in response to grazing or rest. Short internodes develop in the rhizomes under season long grazing at the same time reduction in leaf length occurs. The majority of photosynthetic material can become unavailable to ungulates. The species can maintain itself in the stand by increasing the number of shoots/unit area from short rhizome internodes. Stem numbers per unit area are maximized at the expense of foliar biomass. Density and composition of bluegrass can be similar between good and fair forage rating even though standing crop production will decline.

A grazing system which provides periodic rest improves carbohydrate reserves in the root, leads to more vigorous aerial shoots, and greater standing crop production. Continued rest thickens the litter layer, increases shading of leaf sheaths and elongates rhizome internodes so fewer aerial shoots develop per unit area even though individual shoot length remains vigorous. Bluegrass remains a satisfactory competitor under light to heavy grazing and behaves as a palatable increaser because of its morphological flexibility and ability to reproduce vegetatively under conditions not conducive to seedling establishment and growth of decreaser bunchgrasses.

These bluegrass meadows contain a great variety of grasses, sedges and forbs. Grasses and sedges are more prevalent in the more protected, lightly used meadows. Slender wheatgrass, junegrass, bentgrass, Williams needlegrass, timothy, slenderbeak sedge and Nebraska sedge are prevalent

but never with enough individuals per species to be called a codominant. Forbs as penstemon, Oregon globemallow, agoseris, aster, cinquefoil, longstalk clover, pussytoes, western yarrow and dandelion are more evident in fair and poor forage rating or following site disturbance as rodent infestations and underburning.

Kentucky bluegrass moist meadow in good forage rating, this particular stand has not been grazed for 15 years. Herbaceous production averages 1500 lb/acre dry weight. Bare soil and pavement is 5%.

Closeup of Kentucky bluegrass meadow in good forage rating. Mat muhly, baltic rush and western yarrow are very subordinate.

Most of the perennial bunchgrasses are palatable to livestock and will decrease under sustained grazing pressure during the actively growing period. Kentucky bluegrass, California oatgrass, most sedges and the perennial forbs are also palatable to livestock but increase with overuse. These meadows do not generally support shrubs except occasionally willows may grow along perennial streams. Protection from livestock grazing, especially when coupled with a lowering of the water table, will increase the invasion of lodgepole pine onto these meadows. Many of the perennial forbs and grasses are mildly shade tolerent; however, forage production decreases significantly once tree canopy cover increases above 20-25%.

Kentucky bluegrass meadow dominated by lodgepole pine samplings. Tree invasion onto moist meadows occur when sites are protected from recurring fire and season-long livestock grazing.

These sites are generally preferred forage areas by livestock over the more moist tufted hairgrass and sedge meadows. Kentucky bluegrass meadows generally are more palatable into mid-summer than are the drier meadows dominated by Cusick bluegrass. As a consequence, the Kentucky bluegrass meadows receive the most grazing pressure while they are available to be grazed. However, the growth characteristics of Kentucky bluegrass provides a resiliency to grazing which is unmatched by perennial bunchgrasses. As a result bluegrass meadows generally provide the most effective site protection for the grazing intensity of any meadow communities occurring within central Oregon.

The main disruptive forces on this meadow community are rodent infestations and lowered water tables. Populations of Columbia ground squirrels fluctuate considerably over the seasons. Their impact on species composition, plant vigor and productivity are most apparent on fair and poor rated meadows. The heavier squirrel infestations increase prevalence of perennial forbs. Studies indicate about a decade is

required for Kentucky bluegrass to again occupy a site once devastated by ground squirrels. The lowering of the water table through channel cutting, poor road location or droughty climatic patterns tends to change site potential. Kentucky bluegrass can tolerate a fairly wide range of temperature and moisture. However, as water tables are lowered, stands tend to become more dominated by forbs and the unpalatable increasers. Raised water tables will favor sedges, bentgrass and tufted hairgrass. Little is known about the effect of periodic underburning on this community. Burning can be used to control invasion of conifers and shrubs, or to remove accumulations of litter. Cool burns should have little effect on rhizomatous species. The response of the perennial bunchgrasses will depend upon plant vigor, season of burn with respect to active growth, and the ability to control grazing following the burning period.

Infestation of ground squirrels destroys bluegrass sod and leads to temporary dominance of silverweed.

SITE DESCRIPTION

The guide is restricted to the pumice deposition zone of Deschutes, Fremont and Winema National Forests. These meadows occur on flat to slightly convex microrelief of basins, drainages, lake terraces and flats. Slopes rarely exceed 2%. Stands typically are surrounded by lodgepole pine which tolerates poor soil aeration and cold temperatures better than any associated conifer.

Soils are derived from shallow to moderately deep pumice alluvium overlying outwash sand, basalt alluvium, cinders or pumice from a previous eruption. The buried soil is usually less than 6 feet below the soil surface. Soil profiles generally contain a silty loam surface horizon grading into

a well mixed AC horizon lying directly over a coarse pumice layer. A water table is usually within 45 inches of the soil surface in early summer but may retreat to well below rooting depth by mid-summer.

Soil profile developed from alluvial air-laid pumice showing a water table in mid July at 37 inches. Kentucky bluegrass rooting depth is generally above 20 inches.

FORAGE RATING

Forage rating is based upon 1) forage cover, 2) forage composition, and 3) plant vigor. A qualitative description for each of four condition classes follows. These descriptions generally apply to their ecological status where late seral is similar to good, mid seral to fair, early seral to poor and very early seral to very poor.

Good: Kentucky bluegrass dominates the stand with scattered individuals or colonies of slender wheatgrass, Williams needlegrass, and/or junegrass. Tufted hairgrass widely scattered but subordinate to Kentucky bluegrass. Baltic rush, analogue sedge, Nebraska sedge, mat muhly and California oatgrass widely distributed but not as dense colonies. Perennial forbs as agroseris, penstemon, Oregon globemallow, western aster, cinquefoil, longstalk clover, dandelion, pussypaws and strawberry are scattered small colonies or individual plants definitely subordinate to Kentucky bluegrass. Bluegrass growth form as vigorous, erect, loosely clustered tillers growing through a loosely matted litter layer. Shading definitely having noticeable effect on culm density. Annual forbs restricted to recently created rodent mounds.

Kentucky bluegrass moist meadow in good forage rating. Herb production is 1670 lb/acre dry weight. Perennial forbs restricted to very localized colonies.

Fair: Kentucky bluegrass slightly dominates the stand or codominant with mat muhly and perennial forbs as measured by species composition or biomass production. Decreaser grass species are present but very scattered individuals. Baltic rush, and analogue sedge may be codominant, aggregated as groups. Common perennial forbs are western yarrow, western aster, flattop pussytoes, strawberry and longstalked clover. These species are usually as large colonies contaminated with bluegrass, mat muhly and Baltic rush. Annual forbs occur on rodent mounds and localized livestock dusting sites. Bluegrass growth form is erect, tightly clustered tillers growing through a compacted litter layer. Culm density is affected more by plant vigor and growth form than shading. Bluegrass noticeably expanding onto disturbed sites due to vigorous rhizome elongation even though species is preferred forage. This forage class common under season-long, moderate use where plants have little opportunity to regain vigor except during midsummer period.

Kentucky bluegrass moist meadow in fair forage rating. Bluegrass broken with bare ground openings which are dominated by annuals and mat muhly. Herbaceous production is 1900 lb/acre dry weight. This meadow has been rested from sheep grazing for 10 years.

Kentucky bluegrass moist meadow in fair forage rating as a result of season-long cattle use. Mat muhly is codominate with bluegrass. Perennial forbs as yarrow, pussytoes, dandilion common in openings of grass sod. Herbaceous production is 1300 lb/acre dry weight.

Poor: Kentucky bluegrass subordinate to perennial forbs and unpalatable increaser grasses as measured by species composition or biomass production. Western yarrow, western aster, dandelion, flattop pussytoes, strawberry, longstalked clover and baltic rush usually occur in dense colonies. Mat muhly, California oatgrass, Neveda sedge, analogue sedge may be codominant with bluegrass. Bluegrass growth form is decumbent with tillers arising close together from short rhizomes. Litter layers compacted and may be absent where perennial forbs dominate. Silverweed and annual forbs as sandwort and cudweed common on rodent mounds, salt grounds or dusting beds. Little evidence of bluegrass invasion onto disturbed sites. This condition may also occur where lodgepole pine has invaded a meadow site and reduced herbaceous cover from tree canopy closure. No significant loss in species has occurred only changes in composition, vigor and production.

Kentucky bluegrass moist meadow in poor forage rating. Codominance of mat muhly, yarrow, aster, dandilion, clover and analogue sedge with Kentucky bluegrass. Sod not broken but species composition significantly degraded. Season-long cattle use.

Closeup of Kentucky bluegrass meadow is poor forage rating showing dominance of mat muhly and perennial forbs. Herbaceous production is 1500 lb/acre dry weight.

Very Poor: Kentucky bluegrass, California oatgrass and Nebraska sedge found as small, widely scattered colonies. Decreaser species are absent. Mat muhly, analogue sedge and baltic rush are as dense colonies within an open stand of perennial or annual forbs. Western yarrow, strawberry, hoary aster, silverweed, cudweed and sandwort are the most common forbs. Litter layer usually absent except within colonies of bluegrass or mat muhly.

Kentucky bluegrass moist meadow in v. poor forage rating. Sod broken by season-long cattle grazing when soils excessively moist. Bare soil and pavement is 65%. Herbaceous production is 900 lb/acre dry weight.

Closeup of bluegrass meadow in very poor forage rating. Dense colonies of pussytoes, high percentage of bare soil. Alkali muhly, analogue sedge and baltic rush dominate over Kentucky bluegrass.

FORAGE COVER RATING

Use of the three-step method in these moist meadows usually gives 40 to 55 direct hits on herbaceous plants per 100 feet of transect in good condition. About 60% of these direct hits occur on decreaser and palatable increaser species. The method is less sensitive to a change from good to fair rating than from fair to poor within this community. Usually species composition is very similar between good and fair with major differences being in culm density and plant vigor.

A maximum of 25 points is assigned to forage cover. The following table lists the point rating by the number of herbaceous decreaser and palatable increaser plant hits averaged for a cluster of two or more transects.

Number of hits	Point Rating
22 +	20-25
14-21	13-19
7-13	6-12
0-6	0-5

FORAGE COMPOSITION RATING

A maximum of 65 points is assigned to forage composition. Forage composition rating is calculated in the following manner. Assign one point for each percent composition of herbaceous decreasers and palatable increasers. Disregard any palatable increaser forb composition in excess of 10% and any palatable increaser grass composition in excess of 55%. Add the resulting palatable increaser composition to the decreaser composition and rate forage composition by entering the following table:

Calculated Composition Points	Composition Rating
75+	52-65
56-74	40-51
36-55	27-39
16-35	14-26
0-15	0-13

Maximum Limits
pal. incr. forbs 10%
pal. incr. grass 55%

PLANT VIGOR RATING

Plant vigor responds to annual weather patterns and grazing use. Site potential must be determined each year from recently installed utilization cages which have not received livestock use the current season. The following guide is used to rate plant vigor that results from livestock grazing on a 10 point scale:

Description	Rating
Kentucky bluegrass with tiller dominated top growth; stems dense and much elongated with respect to leaves. Average maximum leaf or seed stalk length exceeds 75% of seasonal potential as measured from ungrazed plants. Over 30% of plants are seedlings or immature individuals, decadence rare. This vigor exists on previously deteriorated meadows with maximum upward trend	9 - 10

	Description	Rating
	Mortality of mature bunchgrass plants occasionally evident within some basal clumps. Root crowns intact, firmly rooted and show few signs of weakness. Kentucky bluegrass with tiller dominated top growth; stems not dense but much elongated with respect to leaves. Average maximum leaf or seed stalk length between 51% and 75% of seasonal potential as measured from ungrazed plants. Less than a quarter of plants are seedlings or immature individuals. Seedling decadence occasional. This vigor exists on previously deteriorated meadows which have received an extended period of rest and are approaching good forage rating	6 - 7 - 8
	Root crowns of mature bunchgrass displaced with some effort, occasional pedestaling. Kentucky bluegrass with rhizome-dominated top growth; leaves much dominant over stem growth. Average maximum leaf or seed stalk length between 26% and 50% of seasonal potential as measured from ungrazed plants. Seedling or immature individuals less than 10% to 15% of plants present. Seedling decadence common. This vigor exists on poor range with little or no uptrend or those in better rating which have received early season use over extended period of time	3 - 4 - 5
	Root crowns of mature bunchgrass plants usually pedestaled or weak and easily displaced. Kentucky bluegrass with rhizome-dominated top growth; stems very sparse as compared to leaf production. Average maximum leaf or seed stalk length less than 25% of seasonal potential. Seedling or immature individuals not evident or very occasional. This vigor exists on deteriorated meadows which receive continued over use	0 - 2
FORAGE PRODUCTION	Forage production averages 1835 lbs/A air dry weight ± 200 lbs. at 95% confidence interval for stands in fair and better forage rating. The experienced range is 1400 to 2300 pounds depending upon site quality, past grazing history and yearly climatic variations. Climate or rest from grazing can give a 100% variation from one year to another.[1] Under complete rest bluegrass meadows will	

1/ Refer to Volland, L. A. 1978. Trends in standing crop and species composition of a rested Kentucky bluegrass meadow over an 11-year period. Soc. Rge. Mgt. First International Rangeland Congress, Denver, CO, p. 526-529.

increase in production 2.5 times over a four year period, thereafter production declines toward prerest levels. Production of bluegrass meadows can be doubled from season-long grazing by resting the meadows during their growing season for two years. A change of growth form and litter deposition is necessary to substantially increase herbage production. These meadows must receive periodic livestock use in order to maintain their productivity.

SOIL STABILITY RATING

Soil stability is evaluated using two criteria, the amount of ground surface exposed and evidence of current soil erosion. Both the criteria receive an equal weight of 50.

Bare Soil Index

The bare soil index is based on the number of transect hits on bare soil plus pavement, that is, all surface fragments less than 3/4 inch in diameter. Particle size distribution in pumice parent material makes it very difficult to separate bare soil coarse fragments from pavement sized fragments which result from accelerated erosion. Transect hits are averaged for a cluster. Bare soil rating is scored by the following table which is adjusted for central Oregon meadow situations.

Bare Soil + Pavement Hits	Index
Less than 6	45-50
10 - 6	35-44
20 - 11	25-34
30 - 21	15-24
Greater than 30	0-14

Current Soil Erosion Index

The following criteria incorporate natural as well as erosion that is induced by grazing activities:

Description	Rating
No evidence of soil movement. Bare spaces small and well dispersed, not interconnected. Interspaces between bunchgrasses occupied by young perennial forbs and grasses or litter. Rhizomatous species form continuous sod. Litter layer usually continous and exceeds 1.5 inches thick. Pedestalling of perennials from frost heaving and not soil movement. Soil surface friable and porous, not compacted. Trampling displacement not evident. Soil deposition from animal burrows and not water or air movement	41 - 50

Description	Rating
Soil movement slight and local. Bare spaces discontinuous and isolated, usually restricted to areas of rodent activity. Erosion confined to individual bare spaces. Larger interspaces being invaded by perennials. Litter layer thin but not appreciably compacted. Plant pedestalling from frost heaving, not soil erosion or trampling. Soil surface usually porous and friable, being compacted only in interspaces or localized areas. Little evidence of trampling displacement	31 - 40
Soil movement moderate. Bare spaces small but locally continuous and interconnected. Interspaces between bunchgrasses partially occupied by young perennials or litter. Rhizomatous plants occur as large colonies or dense mats, sod not continuous. Litter layer thin and compacted, rarely achieving 1 inch thickness. Plant pedestals due to soil movement or grazing. Pulling up of young perennials during grazing. Soil surface with hummocks and depressions	21 - 30
Soil movement advanced. Bare soil dominates but site still influenced by vegetation and litter. Large bare soil interspaces between perennials are dominated by annuals and younger perennial plants. Sod from rhizomatous species is locally dense but aggregated and discontinuous. Litter layer very thin, highly compacted and lacking in many interspaces. Pedestals common from partial loss of A1 surface soil horizon. Trampling displacement common on wetter sites. Current soil movement not appreciably affected by vegetation or litter cover	11 - 20
Soil movement severe. Bare soil continuous and forms the matrix within which colonies of perennials are growing. Interspaces between perennial plants lack vegetation or dominated by annuals. Rhizomatous species occur as very localized, depauperate colonies. Litter layer either absent or confined to immediate vicinity of perennial plants and obstructions. Most of area uninfluenced by vegetation or litter. Plant pedestals common. Overland movement of soil evident, deposition evident from air or water erosion	0 - 10

RECONNAISSANCE FORAGE AND SOIL RATING

The forage and soil rating of moist bluegrass meadows can be approximated by systematically placing 20 to 30 one-square-foot or .96-square-foot circular plots and ocularly estimating the following attributes:

a. The average crown aggregated for all decreaser grasses.

b. The frequency aggregated for all decreaser grasses.

c. The average percentage of litter cover.

Find the average % cover for each decreaser grass species across all plots. Total these average cover values for decreaser grasses. Determine species frequency across all plots and sum these frequencies for decreaser grasses. The aggregated cover and frequency estimates are compared to the following criteria:

Rating class	Decreaser Cover	Frequency	% Litter Cover
Good	2.40% +	27% +	80-100
Fair	1.45-2.39	19-26	65-79
Poor	.49-1.44	10-18	50-64
Very poor	0-.48	0-9	0-50

All three attributes should be estimated in order to correctly place a stand into a rating class. In many instances litter values for a stand may be high but a much lower frequency or cover value for decreasers will indicate a lower forage rating.

SPECIES LIST

	Decreasers
Agor	Agrostis oregonensis
Agtr	Agropyron trachycaulum
Deca	Deschampsia caespitosa
Kocr	Koleria cristata
Pocu	Poa cusickii
Phpr	Phleum pratense
Stwi	Stipa williamsii
Aggl	Agoseris glauca
Mial	Microseris alpestris
Pery	Penstemon rydbergii
Sior	Sidalcea oregana

	Increasers, Palatable
Agdi	Agrostis diegoensis
Caat	Carex athrostachya
Cane	Carex nebraskensis
Daca	Danthonia californica
Popr	Poa pratensis
Asoc	Aster occidentalis
Pogr	Potentilla gracilis
Raoc	Ranunculus occidentalis
Taof	Taraxacum officinale
Trlo	Trifolium longipes

	Increasers, Unpalatable
Cala	Carex lasiocarpa
Casi	Carex simulata
Juba	Juncus balticus
Muri	Muhlenbergia richardsonis
Acmi	Achillea millefolium
Anco	Antennaria corymbosa
Asca	Aster canescens
Frvi	Fragaria virginiana
Poan4	Potentilla anserina
Soca	Solidago canadensis

	Invaders
Ann	Annual Forbs and Grasses

SUMMARY STATISTICS OF THREE-STEP SAMPLES 1/

	Mean	95% CI	CV	N
Decreaser + Palatable Increaser Hits	29.0	6.55	26	5
Decreaser Hits	1.8	.91	58	5
Palatable Increaser Hits	27.4	6.29	26	5
Decreaser + Palatable Increaser Comp.	68.0	11.14	19	5
Decreaser Composition	4.1	1.29	36	5
Palatable Increaser Composition	63.9	10.53	19	5
Total Hits (all plants)	46.4	7.40	18	5
Species with 80% Presence:				
Poa pratensis				
hits	16.1	2.56	.18	5
composition	39.5	8.97	.26	5
Juncus balticus				
hits	3.0	1.88	.64	5
composition	4.5	3.02	.77	5
Muhlenbergia richardsonis				
hits	5.1	4.69	1.05	5
composition	8.8	7.50	.97	5
Achillea millefolium				
hits	3.6	1.89	.60	5
composition	7.1	4.29	.69	5
Trifolium longipes				
composition	3.1	1.84	.68	5
Litter	45.9	6.25	.16	5
Moss	5.8	6.95	1.23	5
Bare soil + Pavement	3.9	3.13	.82	5

1/ Based on least disturbed stands: 95% CI = 19 out of 20 samples is between ± stated confidence interval assuming a normal distribution. CV: coefficient of variation = std. deviation/mean. N: sample size.

SUMMARY STATISTICS, RECONNAISSANCE RATING GUIDE
(1 sq. ft. Square or Circular Plot)

Attribute	Mean	95% CI	CV	N
Litter cover	90.8	6.6	.09	6
Moss cover	3.8	3.6	1.20	6
Bare soil + Pavement cover	5.2	3.5	.83	6
Poa pratensis				
frequency	97.1	5.7	.07	6
foliar cover	34.3	11.2	.37	5
Juncus balticus				
frequency	53.7	29.5	.68	6
foliar cover	4.3	2.3	.55	4
Muhlenbergia richardsonis				
frequency	48.7	16.1	.41	6
foliar cover	5.6	4.3	.94	6
Deschampsia caespitosa				
frequency	15.0	8.2	.56	
foliar cover	1.1	.4	.37	4
Achillea millefolium				
frequency	70.0	27.2	.44	5
Trifolium longipes				
frequency	62.5	18.5	.34	5
Aster occidentalis				
frequency	62.5	25.2	.46	5
Potentilla gracilis				
frequency	37.0	25.2	.78	5
Decreaser grasses in aggregate:				
foliar cover	2.9	1.2	.54	6
frequency	31.0	4.0	.15	6

Forage Rating Guide
for
CUSICK BLUEGRASS DRY MEADOW

(Ecoclass: MD19-11)

VEGETATION DESCRIPTION

The forage rating guide applies to those non-forest meadows dominated by Cusick bluegrass, a bunchgrass. These are xeric-tending meadows found in association with meadows of more mesic environments downslope and lodgepole pine on more xeric sites upslope. The dry meadows are not as resilient to livestock grazing as Kentucky bluegrass or tufted hairgrass meadows. The dry Cusick bluegrass meadows are invaribly overused when livestock grazing is managed according to key areas dominated by Kentucky bluegrass or tufted hairgrass. After many years of season-long livestock grazing, most of the Cusick bluegrass meadows have degenerated to perennial forbs and annuals. Successional development in these dry meadow environments proceeds slowly because of interspecific competition between rhizomatous and nonrhizomatous species. Rehabilitation to bluegrass dominance usually requires more than grazing management.

The dry meadows contain a variety of grasses, sedges and forbs and have the most diversified species composition in good forage rating than Kentucky bluegrass or tufted hairgrass meadows. Cusick bluegrass is clearly the dominant but is found in association with California oatgrass, slender wheatgrass, prairie junegrass, Williams needlegrass, slender-beak sedge, threadleaf sedge, and analogue sedge. Common forbs are pale agoseris, long-stalk clover, cinquefoil, western yarrow, western aster, Oregon globemallow, common dandelion and pussytoes.

Cusick bluegrass dry meadow in good forage rating. Bare soil and pavement averages 3%. Herbaceous production is 2000 lb/acre dry weight.

Closeup of Cusick bluegrass meadow in good forage rating showing density of bluegrass clumps with interspaces dominated by Carex filafolia.

The most palatable species are the bunchgrasses as Cusick bluegrass, California oatgrass and prairie junegrass. These meadows are preferred by livestock early in the growing season before the vegetation dries in mid to late July. Consequently, under seasonlong use the plants are usually grazed when they are more susceptible to damage. Dry meadows in poor to very poor forage rating are fairly common. Those in good condition are rare and normally located where livestock access is limited.

The species composition and dominance of dry meadows is very sensitive to fluctuations in the water table. These sites are imperfectly drained in early spring. By mid summer water tables are below the plant rooting zone. Stream channel cutting, poor road location or drought may lower water tables earlier in the season so the vegetation becomes more sensitive to grazing use. Nothing is known about the effect of prescribed burning on this plant community. Generally a bunchgrass as Cusick bluegrass is more sensitive to burning than a rhizomatous species as Kentucky bluegrass. Close coordination between season of burning and grazing management is necessary to prevent utilization of bunchgrasses twice in the same growing season.

SITE DESCRIPTION

The guide is restricted to the pumice deposition zone of the Deschutes, Fremont and Winema National Forests. These meadows occur on flat microrelief of basins or drainages. Slopes are less than 2%. Dry meadows are associated with Kentucky bluegrass moist meadows. The dry meadows occasionally form a ring or perphery around or adjacent to these moist meadows. Lodgepole pine grows adjacent to dry meadows with a slight gain in elevation.

Soils are derived from shallow to deep pumice alluvium overlying basalt or andesite alluvium. The buried soil is usually less than 6 feet below the soil surface. Soil profiles have coarse sandy loam to silt loam surface textures grading into a well mixed AC horizon. A coarse pumice layer may be present below the AC horizon depending upon where in the deposition zone one is located. A water table may be found within 45 inches of the soil surface in early spring or early summer. The profile will not contain a water table by mid to late summer. Livestock grazing during the period of a perched water table may result in soil compaction, severe soil displacement or pedestaling of bunchgrass clumps.

Alluvial airlaid pumice soil profile characteristic of Cusick bluegrass meadow showing rooting depth to 14 inches. Water table is at 40 inches in mid July. Dark circular patches are rodent krotovinas. 1 dm=4 inches.

FORAGE RATING

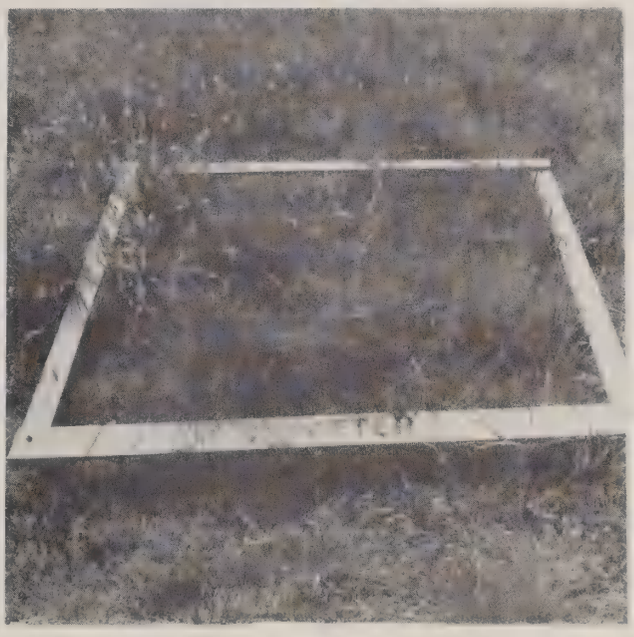
Vegetation condition is based upon 1) forage cover, 2) forage composition and 3) plant vigor. A qualitative description for each of four forage classes follows. These descriptions generally apply to the ecological status of Cusick bluegrass meadows where late seral is similar to good, mid seral to fair, early seral to poor and very early seral to very poor.

Good: Cusick bluegrass is dominant and evenly distributed across the stand. Slender wheatgrass, prairie junegrass and California oatgrass are strong subordinates. Tufted hairgrass and Williams needlegrass are occasionally present. Mat muhly, Baltic rush and Kentucky bluegrass, if present, as very localized colonies. Slenderbeak sedge, threadleaf sedge and analogue sedge scattered through stand but not prominent. Perennial forbs as longstalk clover, cinquefoil, western yarrow and western aster subordinate to Cusick bluegrass and not aggregated as colonies. Interspaces between bluegrass clumps are dominated by litter rather than perennial or annual forbs. Cusick bluegrass clumps are rarely pedestaled and without dead centers.

Cusick bluegrass dry meadow in good forage rating showing general and closeup view. Dominant species are Cusick bluegrass, slenderbeak sedge, slender wheatgrass, western yarrow and potentilla. Bare soil and pavement average 6% cover. Herbaceous production is 2800 lb/acre dry weight.

Fair: Cusick bluegrass is codominant to species as mat muhly, prairie junegrass, Baltic rush, Kentucky bluegrass, California oatgrass, analogue sedge, and threadleaf sedge. Tufted hairgrass, slender wheatgrass, Williams needlegrass are rare. Perennial forbs as western yarrow, western aster, longstalk clover, cinquefoil, dandelion, corymbose pussytoes as large colonies or commonly dispersed within interspaces of bunchgrass clumps. Litter layer usually not continuous, somewhat compacted. Cusick bluegrass clumps show pedestals, dead centers and some pattern to their distribution. Annual forbs common in interspaces especially in moist growing years.

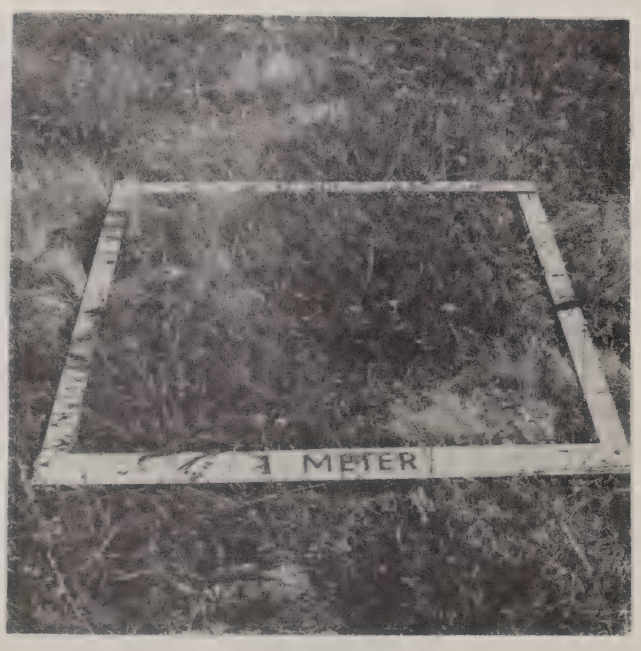
Cusick bluegrass dry meadow in fair forage rating. Composition shared between Cusick bluegrass, mat muhly, Baltic rush and analogue sedge with interspaces dominated by perennial forbs as western aster, yarrow and dandelion. Herbaceous production approximates 600 lb/acre dry weight. Bare soil and pavement is 15%.



Poor: Cusick bluegrass is subordinate to other grasses, sedges and forbs. Cusick bluegrass clumps pedestalled and strongly aggregated in the stand. Mat muhly, Baltic rush, analogue sedge and pullup muhly as large colonies. Stand dominated by perennial forbs as western yarrow, pussytoes, cinquefoil, western aster, hoary aster and dandelion. Localized colonies of iris, barestem lomatium, or goldenweed may be present. Annual forbs as chickweed, collinsia and cudweed prevalent. Litter layer is compacted and broken in distribution. Interspaces between bunchgrass dominated by rhizomatous grasses, perennial and annual forbs.

Cusick bluegrass dry meadow in poor forage rating. Bare soil + pavement averages 26%. Herbaceous production averages 600 lb/acre dry weight.

Closeup of poor rated dry meadow showing dominance of mat muhly, western yarrow, buttercup and potentilla. Decreaser grasses are strongly aggregated, interspaces have perennial forbs and rhizomatous grasses.



Very Poor: Cusick bluegrass clumps very occasional, strongly aggregated into small, irregular spaced colonies. Stand dominated by large colonies of mat muhly, California oatgrass, analogue sedge, Baltic rush and perennial forbs, as hoary aster, tansyleaf evening primrose, goldenweed and barestem lomatium. Heavily grazed stands may be lacking Cusick bluegrass, prairie junegrass, California oatgrass. Annual forbs common in areas not containing litter. Litter layer usually absent or very discontinuous.

Cusick bluegrass dry meadow in very poor forage rating showing remnant clumps of severally pedestalled Cusick bluegrass and isolated colonies of Nevada bluegrass as result of season-long cattle use. Bare soil + pavement is 45% cover. Herbaceous production is 125 lb/acre dry weight.

FORAGE COVER RATING

Use of the three-step method in Cusick bluegrass meadows results in 30 to 45 direct hits on herbaceous plants per 100 feet of transect in good forage rating. About 50-65% of these direct hits occur on decreaser and palatable increaser species. A maximum of 25 points is assigned to forage cover. The following table lists the point rating by the number of herbaceous decreaser and palatable increaser plant hits averaged for a cluster of two or more transects.

Number of hits	Point Rating
19 +	20-25
11-18	13-19
5-10	6-12
0-4	0-5

FORAGE COMPOSITION RATING

A maximum of 65 points is assigned to forage composition. Forage composition rating is calculated in the following manner. Assign one point for each percent composition of herbaceous decreasers and palatable increasers. Disregard any palatable increaser forb composition in excess of 10% and any palatable increaser grass composition in excess of 10%. Add the resulting palatable increaser composition to the decreaser composition and rate forage composition by entering the following table:

Calculated Composition Points	Composition Rating
68 +	52-65
51-67	40-51
34-50	27-39
17-33	14-26
0-16	0-13

Maximum Limits:

Pal. incr. grass 10%
Pal. incr. forbs 10%

PLANT VIGOR INDEX

Plant vigor responds to annual weather patterns and grazing use. Bunchgrass vigor should be based upon the vigor of Cusick bluegrass. The following guide is used to rate plant vigor that results from livestock grazing on a 10 point scale.

Description	Rating
Rhizomatous grasses with tiller-dominated top growth; stems dense and much elongated with respect to leaves. Average maximum leaf or seed stalk length of mature bunchgrass plants exceeds 75% of potential for the site in the year sampled. Over 30% of plants are seedlings or immature individuals, decadence rare. This vigor exists on previously deteriorated meadows with maximum upward trend	9 - 10

	Description	Rating
	Mortality of mature bunchgrass plants occasionally evident within some basal clumps. Root crowns intact, firmly rooted and show few signs of weakness. Rhizomatous grasses with tiller-dominated top growth; stems not dense but much elongated with respect to leaves. Average maximum leaf or seed stalk length between 51 and 75% of potential for the site in the year sampled. Less than a quarter of plants are seedlings or immature individuals. Seedling decadence occasional. This vigor exists on previously deteriorated meadows which have received an extended period of rest and are approaching good forage rating.....	6 - 7 - 8
	Mortality of mature bunchgrass plants evident within many clumps. Root crowns displaced with some effort, occasional pedestaling. Rhizomatous grasses with rhizome-dominated top growth; leaves much dominant over stem growth. Average maximum leaf or seed stalk length between 26 and 50% of potential for the site in the year sampled. Seedling or immature individuals less than 10 to 15% of plants present. Seedling decadence common. This vigor exists on poor forage rating with little or no uptrend or those in better condition which have received early season use over extended periods of time	3 - 4 - 5
	Internal portions of mature bunchgrass clumps show much mortality. Root crowns usually pedestaled or weak and easily displaced. Rhizomatous grasses with rhizome-dominated top growth; stems very sparse as compared to leaf production. Average maximum leaf or seed stalk length less than 25% of potential for the site in the year sampled. Seedling or immature individuals not evident or very occasional. This vigor exists on deteriorated meadows which receive continued overuse	0 - 2

FORAGE PRODUCTION

Herbaceous standing crop production averages 2300 lbs/A air dry weight for stands in fair and better forage rating. The experienced range in data is 1650 to 2850 pounds depending upon site quality, past grazing history and yearly climatic variations. Stands in poor forage rating produce about 25% of those in good condition.

SOIL STABILITY RATING

Soil condition is evaluated using two criteria, the amount of ground surface exposed and evidence of current soil erosion. Both criteria receive an equal weight of 50.

Bare Soil Index

The bare soil index is based on the number of transect hits on bare soil plus pavement, that is all surface fragments less than 3/4 inch in diameter. Particle size distribution in pumice parent material makes it very difficult to separate bare soil coarse fragments from pavement sized fragments which result from accelerated erosion. Transect hits are averaged for a cluster. Bare soil rating is scored by the following table which is adjusted for central Oregon meadow situations.

Bare Soil + Pavement Hits	Index
Less than 16	45-50
30-16	35-44
45-31	25-34
60-46	15-24
Greater than 60	0-14

Current Soil Erosion Index

The following criteria incorporate natural as well as erosion that is induced by grazing activities:

Description	Rating
No evidence of soil movement. Bare spaces small and well dispersed, not interconnected. Interspaces between bunchgrasses occupied by young perennial forbs and grasses or litter. Pedestalling of perennials from frost heaving and not soil movement. Soil surface friable and porous, not compacted. Trampling displacement not evident. Soil deposition from animal burrows and not water or air movement	41 - 50
Soil movement slight and local. Bare spaces discontinuous and isolated, usually restricted to areas of rodent activity. Erosion confined to individual bare spaces. Larger interspaces being invaded by perennials. Plant pedestalling from frost heaving, not soil erosion or trampling. Soil surface usually porous and friable, being compacted only in interspaces or localized areas. Little evidence of trampling displacement	31 - 40

Description	Rating
Soil movement moderate. Bare spaces small but locally continuous and interconnected. Interspaces between bunchgrasses partially occupied by young perennials or litter. Plant pedestals due to soil movement or grazing. Pulling up of young perennials from grazing when soils are wet. Soil surface with hummocks and depressions due to differential erosion or trampling. Current soil movement occurs in bare soil openings and rodent colonies	21 - 30
Soil movement advanced. Bare soil dominates but site still influenced by vegetation and litter. Large areas of baresoil are dominated by annuals and younger perennial plants. Pedestals common from partial loss of A1 surface soil horizon. Trampling displacement may be common from grazing when soils are wet. Current soil movement not appreciably affected by vegetation or litter cover	11 - 20
Soil movement severe. Bare soil continuous and forms the matrix within which colonies of perennials are growing. Interspaces between perennial plants lack vegetation or dominated by annuals. Most of area unaffected by vegetation or litter. Plant pedestals common. Overland movement of soil evident, deposition evident from air or water erosion	0 - 10

RECONNAISSANCE FORAGE AND SOIL RATING

The forage and soil rating of Cusick bluegrass meadows can be approximated by systematically placing 20 to 30 one square foot square or .96 square foot circular plots and ocular estimating the following attributes:

a. The average foliar cover of Cusick bluegrass.

b. The average number (density) of Cusick bluegrass.

c. The frequency of Cusick bluegrass.

d. The average percentage of litter.

All attributes should be estimated in order to correctly place a stand into a class. In many instances litter values may be high but a much lower frequency or cover value for Cusick bluegrass will indicate a lower rating. The criteria are as follows:

Rating Class	Cusick bluegrass % Cover	Density	Frequency	% Litter
Good	25%+	2.3+	76%+	80%
Fair	16-24	1.4-2.2	51-75	65-79
Poor	7-15	.7-1.3	26-50	50-64
Very Poor	0-6	.0- .6	0-25	0-50

SPECIES LIST

Decreasers

Agor	Agrostis oregonensis
Agtr	Agropyron trachycaulum
Cafi	Carex filifolia
Deca	Deschampsis caespitosa
Kocr	Koleria cristata
Pocu	Poa cusickii
Stwi	Stipa williamsii
Aggl	Agoseris glauca
Mial	Microseris alpestris
Sior	Sidalcea oregana

Increasers, Palatable

Caat	Carex athrostachya
Cane	Carex nebraskensis
Daca	Danthonia californica
Popr	Poa pratensis
Asoc	Aster occidentalis
Pogr	Potentilla gracilis
Raoc	Ranunculus occidentalis
Taof	Taraxacum officinale
Trlo	Trifolium longipes

Increasers, Unpalatable

Casi	Carex simulata
Juba	Juncus balticus
Muri	Muhlenbergia richardsonis
Acmi	Achillea millefolium
Anco	Antennaria corymbosa
Asca	Aster canescens
Cifo	Cirsium foliosum

Invaders

Hahi	Haplopappus hirtus
Irmi	Iris missouriensis
Lonu	Lomatium nudicaule
Sein	Senecio integerrimus
Ann	Annual forbs and grasses

SUMMARY STATISTICS OF THREE-STEP SAMPLES 1/

	Mean	95% CI	CV	N
Decreaser + Palatable Increaser Hits	23.6	3.66	.18	5
Decreaser Hits	18.7	3.20	.19	5
Palatable Increaser Hits	4.9	2.28	.53	5
Decreaser + Palatable Increaser Comp.	59.8	13.29	.25	5
Decreaser Composition	40.7	9.79	.27	5
Palatable Increaser Composition	19.1	7.71	.46	5
Total Hits (all plants)	38.3	7.58	.22	5
Species with 80% Presence:				
Poa cusickii				
hits	13.3	6.61	.57	5
composition	26.2	13.80	.60	5
Koleria cristata				
composition	5.4	4.55	.96	5
Muhlenbergia richardsonis				
hits	1.6	.84	.52	4
composition	3.0	1.83	.70	5
Achillea millefolium				
hits	4.1	2.76	.77	5
composition	11.9	5.57	.53	5
Aster occidentalis				
composition	2.6	3.40	1.49	5
Trifolium longipes				
composition	5.7	1.85	.33	4
Litter	45.7	10.01	.25	5
Moss	8.1	8.40	1.18	5
Bare soil + Pavement	7.9	8.75	1.26	5

1/ Based on least disturbed stands. 95% CI: 19 out of 20 samples lie between ± stated confidence interval assuming a normal distribution. CV: coefficient of variation = std. deviation/mean. N = sample size.

SUMMARY STATISTICS, RECONNAISSANCE RATING GUIDE
(1 sq. ft. Square or Circular Plot Data)

Attribute	Mean	95% CI	CV	N
Litter cover	88.5	10.0	.13	5
Moss cover	3.1	2.0	.75	5
Bare soil + Pavement cover	8.3	9.2	1.25	5
Poa cusickii				
density	2.6	1.3	.56	5
frequency 1/	84.0	20.6	.28	5
foliar cover	24.7	12.8	.59	5
basal area cover	4.9	2.95	.61	4

1/ Average frequencies for other species are:

Muhlenbergia richardsonis 33.1%, *Koleria cristata* 1.4%, *Achillea millefolium* 68.7%, *Aster occidentalis* 29.0%, *Trifolium longipes* 61.7%.

Forage Rating Guide
for
SAGEBRUSH/BUNCHGRASS

(Includes Ecoclass: SD19-12, SD29-12, SD29-13)

VEGETATION DESCRIPTION

This guide applies to those non-forest plant communities which have either low or big sagebrush as the dominant shrub and Idaho fescue or bluebunch wheatgrass as the dominant herbaceous species. Fescue is prevalent on north, east, westerly aspects and higher elevations. Wheatgrass is more prominent on southerly aspects and lower elevations. These two bunchgrasses often occur together on east and west aspects. Antelope bitterbrush may be codominant with sagebrush on deeper soils or absent completely on steep slopes or shallow soils. Associated shrub species as Wyeth buckwheat, may decrease with big game use or increase under livestock grazing without game browsing. Unpalatable shrubs as green and gray rabbitbrush or goldenweed increase considerably from overgrazing or underburning, especially on deep sandy soils of alluvial fans and toe slope positions. Western juniper may be present and increases from overgrazing or fire protection to become an overstory dominant on those sites supporting bitterbrush.

Low sagebrush/Idaho fescue scabflat in good forage rating. Shrub cover is 12%, herbaceous production is 60 lb/acre dry weight.

Big sagebrush/ wheatgrass on south aspect of cinder cone. Bitterbrush and juniper subordinate. Good forage rating. Sage cover is 20%, bitterbrush cover 10%. Herbaceous production is 325 lb/acre dry weight.

Big sagebrush-Bitterbrush/ Idaho fescue on undulating plateau in good forage rating and climax condition. Sagebrush cover is 6%, bitterbrush cover 11%. Herbaceous production is 150 lb/acre dry weight.

Idaho fescue and bluebunch wheatgrass are palatable to livestock and will decrease under season-long grazing pressure. Most of the other grasses as bluegrass, oatgrass, needlegrass and squirreltail are palatable for livestock but increase with overuse. Cheatgrass, although present on many sites, increases only in those stands having deep sandy soils as undulating plateaus, terraces, alluvial fans and lower third to toe slopes of escarpments. These communities support a variety of perennial forb species most of which are not preferred livestock forage. Bitterbrush

and perennial grasses provide much of the available forage. Overgrazing by livestock or deer can reduce bitterbrush to a very subordinate position in the stand.

Wildfire and prescribed burning reduces sagebrush and bitterbrush considerably so the stand becomes dominated by grasses. Stands located on buttes and escarpment slopes may be dominated by perennial grasses for 30 to 40 years following burning. Rabbitbrush, goldenweed and buckwheat are less susceptible to burning and usually are prevalent within the first 10 years. Bitterbrush is more aggressive than sagebrush in occupying burned over stands in good forage rating.

Twenty-five year old burn in big sagebrush/wheatgrass-fescue which reduced stocking of juniper and sagebrush. Sagebrush cover is 12%. Herbaceous production is 350 lb/acre dry weight. Good forage rating with minimum shrub ecological condition.

SITE DESCRIPTION

The guide is restricted to the pumice deposition zone of Deschutes, Fremont and Winema National Forests. Topography varies from steep to undulating slopes of buttes, escarpments, and lava plateaus. The steepest slopes rarely exceed 50% and those being restricted to buttes and escarpments. Stands most commonly occur in the transition zone between the coniferous forest and the shrub steppe or are a representation of the shrub steppe communities found on the drier sites within the coniferous forest. Soils are derived from shallow, well-mixed pumice overlying a buried soil from basalt, or andesite colluvium, tuff, cinders or pumice from a previous eruption. The buried soil is usually less than 30 inches below the soil surface. Soil profiles are typified by a well mixed AC horizon lying directly over a buried soil. Surface textures vary from coarse sandy loam to silt loams. Surface rock and pavement as well as profile stone are common where colluvial parent material occurs. Coarse pumice particles usually average less than 10mm in diameter and 15% of horizon volume.

Low sagebrush/ fescue soil from air-laid pumice deposited 12 inches deep over a stony clay buried profile. These shallow soils are poorly drained in spring months. 1 dm=4 inches.

Big sagebrush/ Idaho fescue soil at lower third slope position of escarpment showing mixing of colluvial gravels with Mazama dacite pumice. Shrub rooting depth to 40 inches. 1 dm=4 inches.

These sites are generally the earliest to reach range readiness in both forage development and soil moisture content. The AC horizon usually approaches wilting point by mid July. For these reasons late winter to early spring underburning is less detrimental to both the soil and vegetation than summer or early fall burns.

FORAGE RATING

Forage rating is based upon 1) forage cover, 2) forage composition and 3) plant vigor. These descriptions generally apply to stands in climax to mid seral ecological status in which sagebrush cover increases with a decline in forage rating from livestock grazing or is absent from stand due to underburning. Data are not available at this time for adequately rating very early and early ecological status.

Herbaceous plant frequency increases as a result of shrub removal by burning. Forage rating tends to improve slightly in the absence of overuse by livestock until shrubs again regain dominance of the site. The change in the herbaceous layer is more reflected in standing crop production than the closest perennial composition or three-step loop frequency. The density of herbaceous species increases very little following shrub removal as compared to their basal area or their standing crop production. The degree of change in basal area compared to distance between individuals changes so slightly that as small plot as 3/4 inch diameter is not able to detect a significant improvement when only 200 to 300 feet of transect are sampled.

As shrubs and/or western juniper reestablish following burning, forage rating declines especially as shrub or tree cover approaches and exceeds 20% canopy. Forage rating must be adjusted to reflect the changes in the herbaceous and shrubby vegetation. Higher forage cover criteria are required to maintain good rating in the absence of shrubs. As shrubs increase and forage hits decline the tendancy will be to underrate stands having shrubs in excess of 20% crown cover. Consequently an adjustment in forage cover rating is provided based upon the amount of shrub cover present.

Each description is divided into three categories of shrub cover: (1) that present under climax condition, 10 to 25% total cover of any species; (2) the maximum shrub crown cover possible, in excess of 25% cover; and (3) minimum shrub cover which might result from prescribed (or accidental) burning. A qualitative description for each of four classes follows.

Good: (1) Climax -- Shrubs well distributed with aggregated canopy coverage for all species between 10 and 25%. Western juniper absent or less than 5% cover on sites where it will establish and grow. Bitterbrush may be co-dominant with big sagebrush or absent; absence indicates a soil-topography situation not conducive to bitterbrush establishment. Dominant perennial grasses are Idaho fescue and bluebunch wheatgrass, evenly distributed and fully occupying shrub interspaces; individuals not pedestaled and with few dead centers; moderate number of young plants. Vigor is generally moderate. Forbs such as balsamroot, western yarrow, tailcup lupine, phacelia and threadleaf fleabane as

occasional plants within interspaces between bunchgrasses. Wyeth buckwheat, bluegrasses, western and Thurber needlegrass, prairie junegrass, and squirreltail occasional. Green and gray rabbitbrush or goldenweed scarce and usually as a few strongly aggregated individuals widely scattered across stand. Annuals restricted to interspaces and not forming large colonies; abundant and vigorous only in very moist years.

Big sagebrush/ fescue in climax ecological condition and good forage rating. Sagebrush cover is 25%. Herb production is 290 lb/acre dry weight.

(2) Maximum Shrubs - Shrubs well distributed and dense in cover, western juniper may be common on sites conducive to its establishment, often dominated by young trees. Bitterbrush may not be well represented due to past overuse, but all age classes represented. Idaho fescue and bluebunch wheatgrass well distributed and occupying interspaces between shrubs, individuals not pedestaled and with few dead centers, density 20 to 30% lower than in climax. Vigor poor due to maximum competition with shrubs (and not due to livestock use). Forbs in moderate density, and only fair to poor in vigor, occupying interspaces between shrubs and bunchgrasses. Annuals very sparce except in larger openings of shrub canopy.

Big sagebrush-bitterbrush/ fescue with maximum shrub cover (35%) in good forage rating. Herb production 175 lb/acre dry weight.

(3) Minimum Shrubs - Relatively open stand of well distributed low or big sagebrush, canopy cover usually less than 10%, or sagebrush clumped but near absent from stand due to past underburns. Western juniper usually absent from past underburning or if present, represented by less than 2-5 mature trees/acre. Bitterbrush may be codominant or slightly subordinate to big sagebrush. Absence of bitterbrush does not imply a lower range condition but a soil-topography situation not conducive to its establishment or a stand history as underburning which has removed the species. All age classes of either big sagebrush or bitterbrush are represented when the species are present. Green and gray rabbitbrush or goldenweed scarce and usually as a few strongly aggregated individuals widely scattered across stand, up to 10% cover as result of burning, not successfully occupying large areas.

Big sagebrush/ bunchgrass burned 30 years previously. Minimum shrub cover (5%) and good forage rating. Herbaceous production is 400 lb/acre dry weight. Composition primarily fescue, wheatgrass, Sandberg bluegrass and junegrass.

Dominant perennial grasses as Idaho fescue or bluebunch wheatgrass evenly distributed, individuals not pedestaled or with dead centers. Forbs as balsamroot, western yarrow, tailcup lupine, phacelia and threadleaf fleabane as occasional plants within interspaces between bunchgrasses. Wyeth buckwheat, bluegrasses, western and Thurber needlegrass, prairie junegrass and squirreltail occasional. Annual grasses and forbs restricted to interspaces between bunchgrass clumps, not forming large colonies, abundant and vigorous only in very moist years.

Fair: (1) Climax -- Low or big sagebrush clearly the dominant shrub well represented by all age classes, crown cover 10 to 15%. Mature bitterbrush subordinate with immature plants and seedlings present but not common, cover 15-25%. Western juniper with less than 10% cover, slightly more regeneration than mature age class due to past livestock grazing reducing competition for juniper establishment. Bluebunch wheatgrass and Idaho fescue occur in shrub interspaces although openings in grass stand are evident and some aggregation toward shrubs is apparent. Openings between shrubs equally shared between decreaser and palatable increaser grasses. Perennial forbs common in bunchgrass interspaces with slight evidence of aggregation to protected microsites. Rabbitbrush and/or goldenweed subordinate, usually restricted to more disturbed sites. Annual grasses and forbs restricted to larger openings in bunchgrass stand and microsites of recent disturbance, usually more abundant and more vigorous in moist years.

Big sagebrush/ wheatgrass in climax ecological condition and fair forage rating. Shrub cover 16%. Herbaceous production is 150 lb/acre dry weight.

(2) Maximum Shrubs -- Sagebrush, bitterbrush and rabbitbrush crown cover exceeds 25% cover. Bitterbrush represented by mature plants, regeneration having difficulty becoming established due to livestock grazing. Unpalatable increaser shrubs common wherever there is some localized disturbance. Western juniper dominated by younger age classes and well mixed with older age classes. Perennial bunchgrass density being affected by increasing shrub layer, become somewhat restricted to shrub canopy and showing greatest density there. Perennial and annual forbs occur as given under climax status.

Big sagebrush-bitterbrush/ fescue in maximum shrub condition and fair forage rating. Shrub cover 30%, hedged by winter deer use. Herb production is 200 lb/acre dry weight.

(3) Minimum Shrub -- Bitterbrush or sagebrush may be near absent and represented only by younger age classes if stand burned within last 25 years. Absence of bitterbrush mainly due to past livestock grazing or grazing combined with insect predation or underburning. Rabbitbrush and goldenweed may have up to 10% cover due to underburning or soil scarification by livestock grazing. Western juniper with younger age classes, less than 5% cover. Bluebunch wheatgrass and Idaho fescue dominate the site with openings occupied with palatable increasers. Perennial forbs common. Annuals occur as under fair climax condition.

Big sagebrush/ bunchgrass burned 35 year previously. Sagebrush cover 2%; herbaceous production 380 lb/acre dry weight. Minimum shrub condition in fair forage rating. Winter deer use affecting herb composition and density.

Poor: (1) Climax -- Sagebrush, bitterbrush, rabbitbrush goldenweed and mountain mahogany cover approaches 15 to 20% in aggregate. Stand dominated by mature and decadent individuals. Western juniper as younger plants being restricted more toward parent trees. Buckwheat is absent. Bluebunch wheatgrass, Idaho fescue, bluegrass and prairie junegrass restricted to shrub understory, not successfully seeding into openings. Pedestalling of bunchgrasses prevalent on steeper slopes. Palatable increaser grasses as western needlegrass, squirreltail or California oatgrass more common in openings than wheatgrass or fescue. Cheatgrass common on the deep sandy soils. Annual forbs abundant even in drier years. Perennial forbs represented by unpalatable increasers in openings, the palatable increasers are restricted to protection of shrub overstory.

Big sagebrush-bitterbrush/ fescue in climax ecological condition and high poor forage rating. Grasses aggregated to shrubs. Little recruitment toward interspaces. Bitterbrush heavily browsed by deer. Shrub cover 10%, herbaceous production is 120 lb/acre dry weight.

(2) Maximum Shrubs -- Low or big sagebrush in excess of 25% crown cover with preponderance of mature and overmature age classes without adequate regeneration. Age class distribution dominated by decadent and mature plants of bitterbrush, serviceberry and mountain-mahogany suggest these plants not maintaining themselves in the stand because of livestock grazing. Western juniper, if present, represented by younger plants. Rabbitbrush and goldenweed evenly distributed and well represented by all age classes. Sulphur or Wyeth buck wheat not apparent. Herbaceous layer as described under fair, climax conditions.

Big sagebrush/ bunchgrass with maximum shrub cover and poor forage rating. Mortality common in sagebrush, bitterbrush heavily browsed. Fescue restricted to protection of shrubs. Shrub cover 28%, herbaceous production is 70 lb/acre dry weight.

(3) Minimum Shrubs -- Current or past utilization by livestock or big game has selected palatable shrubs from stand. Unpalatable increaser shrubs do not exceed 10%, dominated primarily by the seedling to sapling age class. Stands burned within last 10-15 years characterized by young sagebrush although it may be strongly clumped toward resident survivors. Bitterbrush may be absent from sites which have shallow, stony soils, indicative of low site potential and not forage rating class. Western juniper, if present, represented by younger plants. Bluebunch wheatgrass and Idaho fescue have clumped distribution. Sandberg bluegrass and junegrass much more uniformily distributed. Palatable increaser grasses common throughout larger openings and interspaces between decreasers. Cheatgrass and annual forbs as described under maximum shrubs catagory.

Big sagebrush-bitterbrush/ fescue burned ten years previous. Individual vigor of fescue fair but density poor. Herbaceous production is 150 lbs/acre dry weight.

Very Poor: (1) Climax -- Shrub layer represented by mature and decadent individuals with little regeneration. Palatable shrubs are either high-lined or heavily hedged. Shrub composition dominated by sagebrush and rabbitbrush. Western juniper occurs as scattered young plants. Idaho fescue and bluebunch wheatgrass present but restricted to shrub understory. Palatable increaser grasses are seeding the openings between shrubs. Grasses as bluegrass, junegrass, western needlegrass and squirreltail restricted to protection of shrub canopy or aggregated with poor recruitment. Cheatgrass may dominate openings to near exclusion of perennial grasses. Absence of

cheatgrass is a site induced condition and not due to grazing pressure. Perennial forbs, except for invader species, are scarce. Annual forbs abundant in openings even in drier years.

(2) Maximum Shrubs -- Stand so overgrazed that bitterbrush, serviceberry, Idaho fescue or bluebunch wheatgrass will not recover to satisfactory densities without artificial regeneration. Bitterbrush usually only a occasional plant, young plants rare and die prematurely from browsing. Absence of bitterbrush may be due to shallow, stony soils and/or overgrazing. Low or big sagebrush, rabbitbrush or goldeweed predominate. Age class distribution indicates big sagebrush is not successfully reestablishing itself as compared to rabbitbrush or goldenweed. Sagebrush crown cover may exceed 25-30% in stands not burned for 25 years. In recently burned stands sagebrush cover can approach 20-30% but age class distribution is weighted toward young and immature plants. Perennial and annual forbs and grasses as described under very poor, climax condition.

(3) Minimum Shrubs -- Current or past utilization by ungulates or underburning has reduced palatable shrubs considerably. Unpalatable increaser shrubs do not exceed 10% although expansion potential is much greater. Western juniper primarily seedlings or saplings. Bluebunch wheatgrass and Idaho fescue present in stand as isolated plants or small remnant groups. The main difference between this rating and poor to fair forage rating in the big sagebrush/needlegrass guideline is the (a) presence of remnant wheatgrass and/or Idaho fescue in this community and their total absence from the needlegrass, (b) the absence of coarse-textured rhyolite pumice of Newberry origin for this community guideline, or a Newberry pumice horizon less than 6 inches in depth, (c) prevalence of cheatgrass in these communities and not those dominated by big sagebrush and western needlegrass.

FORAGE COVER RATING

The use of the three-step methods in these communities rarely results in greater than 11 direct hits on herbaceous plants per 100 feet of transect under maximum shrub canopy (greater than 25% cover) in good forage rating or greater than 20 direct hits when shrub cover is less than 10%. Direct hits on herbaceous plants generally increase as shrub cover is reduced under least-disturbed conditions. Forage cover rating is stratified according to three shrub catagories: (1) stands which exceed 25% shrub cover (maximum shrub) represent sites in which past overgrazing has reduced herbaceous vegetation, or shrubs have increased to the detriment

of the herbaceous species, (2) stands which have shrub cover between 10 and 25% represent situations where maximum competition between shrub and herbaceous layers occur in the absence of significant ungulate impacts, and (3) stands with shrub cover less than 10% as a result of past underburning or insect predation with little detriment to herbaceous layer.

There is no significant difference between the combined hits on decreasers and palatable increasers and whether the stand is dominated by low sagebrush or big sagebrush. Differences are not significant between slopes of buttes or escarpments and flatter slopes of alluvial fans or undulating plateaus.

A maximum of 25 points is assigned to forage cover. The following table lists the point rating by the number of herbaceous decreaser and palatable increaser plant hits averaged for a cluster of two or more transects.

	Number of Direct Hits			
Shrub cover:	max.	climax	min.	Point Rating
	9+	12+	14+	20-25
	6-8	8-11	9-12	13-19
	3-5	4-7	5-8	6-12
	0-2	0-3	0-4	0-5

FORAGE COMPOSITION RATING

Forage composition is not significantly related to the presence or removal of the shrub layer, or to any particular environmental factor which can be measured and used as a predictor variable. Decreaser and palatable increaser plant frequency improves by 10 to 20% over a 25 year period following burning of the shrub layer. After 25 years of age the shrub layer regains dominance of the site, plant frequency declines with shrub expansion and increased competition. This change in plant frequency is not statistically reflected in species composition since the closest perennial methodology as used in three-step procedure is not distance dependent.

Forage composition for this forage guide includes herbaceous decreaser and palatable increaser plants. Shrubs are not included because experience has shown they contribute very little to species composition in stands having a fairly dense herbaceous layer.

A maximum of 65 points is assigned to forage compositon. Forage compositon rating is calculated in the following manner. Assign one point for each percent composition of herbaceous and shrub decreasers and palatable herbaceous increasers. Disregard any palatable increaser composition in excess of 30%. If palatable increaser composition is less than 12%, than: (1) subtract the experienced palatable increaser composition from 12%, (2) subtract this difference from the decreaser composition. The resulting composition value is used to rate forage composition by entering the following table:

Calculated Composition Points	Composition Rating
70+	52-65
50-69	40-51
30-49	27-39
10-29	14-26
0-9	0-13

This procedure assures palatable increasers as needlegrass, squirreltail, Sandberg bluegrass and prairie junegrass are considered in rating forage composition. Species diversity and soil stability depend upon an adequate mix of herbaceous decreasers and palatable increasers.

PLANT VIGOR INDEX

Plant vigor responds to annual weather patterns and grazing pressure. Ignore Sandberg bluegrass in these estimates since the species is very responsive to annual climatic variations. The following guide is used to rate the vigor that results from livestock grazing on a 10 point scale:

Description	Rating
Average maximum leaf or seed stalk length of mature bunchgrass plants exceeds 75% of seasonal potential as indicated from caged comparisons. Over 30% of plants are seedlings or immature individuals; decadence rare. This vigor exists only in deteriorated range in maximum upward trend	9 - 10
Mortality of mature bunchgrass plants occasionally evident within some basal clumps. Root crowns intact, firmly rooted and show few signs of weakness. Average maximum leaf or seed stalk length between 51 and 75% of seasonal potential. Less that a quarter of plants are seedlings or immature individuals. Less than 5% of mature plants are decadent, seedling decadence occasional. This vigor exists on deteriorated range in up trend or range approaching good forage rating	6 - 7 - 8

Description	Rating
Mortality evident within many clumps of mature bunchgrass plants. Root crowns displaced with some effort, occasional pedestaling. Average maximum leaf or seed stalk length between 26 and 50% of seasonal potential. Seedling or immature individuals less than 10 to 15% of plants present. Up to 15% of mature plants are decadent; seedling decadence is common. This vigor experienced in any forage class having from moderate down trend to no apparent trend	3 - 4 - 5
Internal portions of mature bunchgrass plant clumps show much mortality. Root crowns usually pedestaled or weak and easily displaced. Seed stalks produced only under favorable climatic conditions. Average maximum leaf or seed stalk length less than 25% of seasonal potential. Seedling or immature individuals not evident or very occasional. Sagebrush is in excellent vigor with more than 15% young plants. This vigor exists on deteriorated range with maximum down trend	0 - 2

FORAGE PRODUCTION

Forage production (excluding shrubs) under the climax and maximum shrub canopy condition averages 290 lbs/A air dry weight $\pm$ 82 lbs at 95% confidence interval. The experienced range is 220 to 360 pounds under good forage rating depending upon site quality and yearly climatic variations. Climate alone can give a 200% variation from one year to another. Production tends to be higher on north and north-easterly aspects, flat to concave microrelief and lower elevations within the 4600 to 6000 foot elevation range sampled. These three environmental attributes (slope direction, microrelief and elevation) account for 60% of the variation experienced in forage production. A regression equation is given for this relationship in the Summary Table.

Native forage production can be doubled in stands rated as good to fair by removing the shrub layer through prescribed fire. Forage rating as evaluated from three-step measurements will show little improvement. Consequently, the use of standing crop production to rate forage condition would give different results than microplot frequency data. As a rough approximation to forage rating, stands supporting 100-200 lbs of herbaceous forage are in poor forage rating while these producing less than 100 lbs are probably very poor rating. Little differentiation can be made between fair and good forage rating.

Production can be increased to 500-700 lbs/A by removing the shrub layer, discing native bunchgrass and drilling introduced species as intermediate and crested wheatgrass. This type of treatment is only recommended in stands supporting big sagebrush, for slopes less than 10% and soils in which a buried profile lies at least 18 inches below soil surface.

SOIL STABILITY RATING

Soil stability is evaluated using two criteria, the amount of ground surface exposed and evidence of current soil erosion. Both criteria receive an equal weight of 50.

Bare Soil Index

The bare soil index is based on the number of transect hits on bare soil plus pavement, that is, all surface fragments less than 3/4 inch in diameter. Particle size distribution in pumice parent material makes it very difficult to separate bare soil coarse fragments from pavement sized fragments which result from accelerated erosion. Transect hits are averaged for a cluster. Bare soil rating is then scored by the following table which is adjusted for central Oregon situations.

Bare Soil + Pavement Hits	Index
Less than 39	45 - 50
47 - 39	35 - 44
56 - 48	25 - 34
65 - 57	15 - 24
Greater than 65	0 - 14

Current Soil Erosion Index

The following criteria incorporate natural as well as erosion induced by grazing activities.

Description	Rating
No evidence of soil movement. Bare spaces small and well dispersed. Interspaces between bunchgrasses occupied by bare soil and pavement with young perennial forbs, grasses, litter or lichen-covered rocks. Canopy of mature grasses usually overhang much of interspaces. Pedestalling of perennials and rock fragments from frost heaving and not accelerated soil movement. Soil dams above older plants are slight or not evident. Soil surface friable and porous, not compacted. Trampling displacement not evident. No active rills or gullies. Soil deposition occurs from animal burrows or colluvial action and not water or air movement	41 - 50

Description	Rating
Soil movement slight and local. Erosion confined to individual bare spaces. Larger interspaces are invaded by perennials. Moss cover stablized in openings. Plant pedestalling from frost heaving, not excessive soil erosion or trampling. Some litter and soil may be accumulated on upslope side of bunchgrasses due to colluvial movement and soil creep. Soil surface usually porous and friable, being compacted only in interspaces or localized areas. Little evidence of trampling displacement. Sheet erosion light and only from severe storms. Slight cupping out below bunchgrasses from wind action	31 - 40
Soil movement moderate. Bare spaces or erosion pavement continuous and interconnected. Interspaces between bunchgrasses partially occupied by young perennials or patches of litter. Plant pedestals due to soil movement or grazing. Soil and plant displacement from grazing animals. Cupping out below bunchgrasses on steeper slopes. Compaction within interspaces evident on flatter ground. Some soil mounds may occur under shrubs. Lichen lines barely evident on large embedded rocks. Current soil movement occurs in bare soil openings and rodent colonies	21 - 30
Soil movement advanced. Even though bare soil or surface rock fragments dominate, the site still influenced by vegetation and litter. Large interspaces between perennials are dominated by annuals and occasionally younger perennial plants. Litter layer is lacking in most interspaces and confined to shrub or grass understories. Pedestals common from partial loss of A1 surface soil horizon or trampling displacement. Heaving and crusting of soil surface common. Current soil movement not being effectively arrested by vegetation or litter cover	11 - 20

Description	Rating
Soil movement severe. Bare soil or surface rock fragments continuous and form the matrix within which colonies of perennials are growing. Interspaces between perennial plants lack vegetation or are dominated by annuals. Litter layer usually absent or confined to immediate influence of perennial plants. Most of area unaffected by vegetation or litter. Soil compaction may exceed 3 to 5 inch depth on flatter ground. Debris dams and excessive soil buildup against obstructions on steeper slopes. Plant pedestals and cupping out of perennials common. Lichen lines on large embedded rocks are obvious and elevated more than 2 inches above surrounding soil. Overland movement of soil evident, deposition evident from air or water erosion	0 - 10

RECONNAISSANCE FORAGE AND SOIL RATING

The forage and soil rating of a sagebrush/bunchgrass community can be approximated by using either a 9.6 sq.ft. circular or a 1 sq.ft. square plot and estimating one of the following attributes for each microplot:

a. The average aggregated crown cover of Idaho fescue and bluebunch wheatgrass plants.

b. The average aggregated number (density) of Idaho fescue and bluebunch wheatgrass plants.

c. The frequency of either fescue or bluebunch wheatgrass, whichever is the most abundant decreaser species.

d. The average percentage of bare soil plus pavement.

At least ten circular or 20 to 30 square plots should be systematically placed after a random start is used. The average of the plots is compared to the criteria listed below. One square foot plot criteria are in parenthesis.

Bluebunch Wheatgrass and Idaho Fescue

Rating Class	Percent Cover		Density	Frequency Shrubs:<20%	Frequency Shrubs:>20%	%BS + Pavemt.	
Good	17%+	(30%+)	3.0%	(2.0%)	(70%+)	(50%+)	0-30%	(0-35%)
Fair	8-16	(15-29)	1.5-2.9	(1.0-1.9)	(40-69)	(26-49)	31-40	(36-45)
Poor	2-7	(5-14)	.8-1.4	(.5-.9)	(20-39)	(11-25)	41-55	(46-60)
Very Poor	0-2	(0-4)	0- .7	(0-.4)	(0-19)	(0-10)	56+	(60 +)

SPECIES LIST

Decreasers

Amal	Amelanchier alnifolia
Putr	Purshia tridentata
Agsp	Agropyron spicatum
Feid	Festuca idahoensis
Posc	Poa scabrella
Crac	Crepis acuminata
Lotr	Lomatium triternatum

Under game use:

Erum	Eriogonum umbellatum
Daun	Danthonia unispicata
Posa	Poa sandbergii

Increasers, Palatable

Caro	Carex rossii
Daca	Danthonia californica
Daun	Danthonia unispicata
Kocr	Koleria cristata
Pole2	Poa leibergii
Pone2	Poa nevadensis
Posa	Poa sandbergii (summer cattle use)
Sihy	Sitanion hystrix
Stoc	Stipa occidentalis
Stth	Stipa thurberiana
Basa	Balsamorhiza sagittata
Baca	Balsamorhiza careyana
Phha	Phacelia hastata
Sein	Senecio intergerrimus

Under game use:

Aggl	Agoseris glauca
Erhe	Eriogonum heracleoides
Lemo	Leucocrinum montanum
Loma	Lomatium martindalei
Luar3	Lupinus argenteus

Increasers, Unpalatable

Arar	Artemisia arbuscula
Artr	Artemisia tridentata
Chvi	Chrysothamnus viscidiflorus
Chna	Chrysothamnus nauseosus
Erhe	Eriogonum heracleoides
Erum	Eriogonum umbellatum
Habl	Haplopappus bloomeri
Acmi	Achillea millefolium
Andi	Antennaria dimorpha
Anro	Antennaria rosea
Astra	Astragulus spp.
Erfi	Erigeron filifolius
Lemo	Leucocrinum montanum
Luca	Lupinus caudatus

Invaders

Ann	All annuals
Brte	Bromus tectorum
Lonu	Lomatium nudicaule
Zigad	Zigadenus spp. (poisonous)

SUMMARY STATISTICS OF THREE-STEP SAMPLES 1/

	Mean	95% CI	CV	N
Decreaser + Palatable Increaser Hits 2/	10.8	2.09	.48	24
Decreaser Hits	8.8	1.71	.49	24
Palatable Increaser Hits	2.8	1.03	.80	24
Decreaser + Palatable Increaser Comp.3/	91.8	2.25	.06	24
Decreaser Composition	65.5	7.64	.29	24
Palatable Increaser Composition	26.4	7.71	.73	24
Total Hits (all plants)	11.7	2.29	.49	24
Species with 80% Presence:				
Artemisia tridentata				
composition	2.5	.91	.70	16
crown cover, line intercept	14.6	3.33	.48	18
crown cover, loop frequency hits	15.9	3.58	.53	24
Purshia tridentata				
composition	2.2	1.17	.91	14
crown cover, line intercept	8.1	2.02	.49	17
crown cover, loop frequency hits	9.1	2.69	.60	20
Festuca idahoensis				
hits	6.4	1.84	.72	24
composition	40.4	8.93	.56	24
Agropyron spicatum				
hits	3.3	1.01	.67	23
composition	25.2	8.76	.81	24
Poa sandbergii				
hits	2.7	.91	.56	13
composition	20.8	6.07	.61	20
Sitanion hystrix				
hits	(too variable to calculate)			
composition	5.9	3.24	1.25	19
Litter	35.2	3.27	.23	24
Moss	10.3	2.86	.68	24
Bare soil + Pavement	34.1	4.42	.34	24
Rock	11.8	4.90	.94	24

1/ Based on least disturbed stands. 95% CI: 19 out of 20 samples lie between ± stated confidence interval assuming a normal distribution. CV: coefficient of variation = std. deviation/mean. N: sample size. 2/ Excludes shrub direct hits. 3/ Includes shrubs in composition.

SUMMARY STATISTICS, RECONNAISSANCE RATING GUIDE
(9.6 sq. ft. Circular Plot Data)

Attribute	Mean	95% CI	CV	N
Litter cover	54.2	5.6	.23	19
Bare soil + pavement cover	30.8	4.7	.34	19
Rock cover	15.7	6.3	.86	18
Agropyron spicatum				
density	1.5	.4	.48	17
foliar Cover	7.3	3.4	.96	16
Festuca idahoensis				
density	2.4	.9	.81	17
foliar Cover	10.4	3.8	.76	17
(1 sq. ft. Square Plot Data)				
Litter cover	50.6	4.6	.23	28
Moss cover	5.3	1.8	.84	26
Bare soil + pavement cover	35.0	4.2	.30	28
Rock cover	10.7	5.3	1.16	25
Agropyron spicatum				
density	.6	.2	.67	24
frequency	39.5	8.5	.50	24
foliar cover	10.4	4.9	1.08	23
Festuca idahoensis				
density	1.2	.3	.67	26
frequency	59.0	11.4	.45	25
foliar cover	17.0	4.7	.66	26
Poa sandbergii				
frequency	40.3	11.6	.61	20
foliar cover	1.6	.7	.76	21
Sitanion hystrix				
frequency	17.8	3.2	1.25	16

FORAGE PREDICTION EQUATION

1. Forage production = 589.80 + 3.32 (slope direction) + 23.24 (microrelief) - .11 (elevation)

F = 6.05 @ 3 and 12 degress of freedom
R^2 = .60
Sy.x = 119 pounds dry weight

Attribute Codes:

Slope direction:	NNE = 40 N, NE = 38 ENE, NNW = 35 E, NW = 32 ESE, WNW = 30 W, SE = 27 WSW, SSE = 25 SW, S = 22 SSW = 20
Microrelief:	convex = 1 flat = 2 concave = 3
Elevation:	given in thousands of feet to the nearest 100 feet.

F = F statistic for testing significance of the equation.

R^2 = Coefficient of determination, measures the amount of variation contained in test data that is accounted for by the equation.

Sy.x = Standard error of estimate of sample mean for dependent variable, gives one standard deviation around mean of dependent variable. One standard deviation includes about 2/3rds of the population variation.

Forage Rating Guide
For
SAGEBRUSH/NEEDLEGRASS

(Includes Ecoclass: SD29-14)

VEGETATION DESCRIPTION

This guide applies to that non-forest plant community which has big sagebrush as the dominant shrub and western needlegrass, bottlebrush squirreltail and Ross sedge as the dominant herbaceous species. Bitterbrush is usually not present. Green rabbitbrush and horsebrush may be subordinate shrubs and become codominants only with overgrazing or excessive site disturbance. Perennial forbs as pussypaws, least lupine, starlily, eriophyllum, Pursh locoweed, low pussytoes, Lewis flax and cushion buckwheat are common, especially in protected stands. Lodgepole or ponderosa pine may occur as occasionals but these environments are generally too xeric and cold to support a tree overstory.

Big sagebrush/ western needlegrass in good forage rating. Pumice gravels from Newberry Crater, Deschutes NF. Sagebrush cover is 23%, herbaceous production is 140 lb/acre dry weight. Bare soil + pavement average 60%.

Closeup of ground cover in big sagebrush/ western needlegrass. Sagebrush cover averages 20%. Bare soil + pavement averages 75%. Herbaceous production is 100 lb/acre dry weight.

Most of the forage comes from squirreltail, Ross sedge and western needlegrass. Available forage production of many stands may be less than 50 lbs/acre dry weight and considered non-range. These forage species are usually early maturing, by early July they have dried and become less palatable. The majority of these stands are located on the eastern edge of the coniferous forest. They provide winter and early spring-late fall forage for mule deer and pronghorn antelope.

Wildfire and prescribed burning reduces sagebrush considerably so the stand becomes dominated with grasses and perennial forbs. Rabbitbrush is less susceptible to burning and increases considerably following burning and reduction of competitors.

Big sagebrush/ needlegrass which has been burned by wild-fire. Scattered shrubs are green rabbitbrush. Bunchgrasses dominated by squirreltail and needlegrass. Production averages 250 lb/acre dry weight.

SITE DESCRIPTION

The guide is restricted to the air-laid rhyolite pumice deposition zone lying east of Newberry Crater on Ft. Rock R.D., Deschutes National Forest. Topography is gently undulating basins and flats. The steepest slopes rarely exceed 7%. Soils are derived from shallow Newberry rhyolite pumice overlying older Mazama pumice and alluvium. Rooting depths are usually less than 30 inches. Surface soil textures vary from coarse sand to loamy sand. The soil surface is usually covered with coarse pumice gravels up to 45mm in diameter. This association is not capable of supporting either Idaho fescue or bluebunch wheatgrass because of the rhyolitic soil properties. Idaho fescue does not occur when the rhyolite pumice approaches 6-8 inch deposition over Mazama ash.

Soil profile showing surface deposition of Newberry rhyolite pumice to 14 inch depth and underlain with dacite pumice from Mt. Mazama. 1 dm= 4 inches.

FORAGE RATING

Forage rating is based upon 1) forage cover, 2) forage composition and 3) plant vigor. These descriptions generally apply to stands in climax to mid seral ecological status in which sagebrush cover increases with a decline in forage rating or is absent from stand due to underburning. Data are not available at this time for adequately rating very early and early ecological status. A qualitative description for each of four classes follow:

Good: Relatively open stand of well distributed big sagebrush, canopy cover usually less than 15% or sagebrush clumped but near absent from stand due to past underburns. Sulfur eriogonum, granitegila are present but subordinate to big sagebrush. Horsebrush and rabbitbrush is occasional. Western needlegrass, Ross sedge and bottlebrush squirreltail occur in the interspaces between shrubs and show vigorous growth when sagebrush has been burned. Common perennial forbs are least lupine, western yarrow, eriophyllum, rockcress, pussytoes and cushion buckwheat. These forbs also found in shrub or bunchgrass interspaces. Litter layer is restricted to shrub understory. Openings between shrubs contain occasional litter and mainly pumice gravels.

Fair: Big sagebrush remains the dominant shrub, canopy 15 to 25%. If the stand burned within 30-40 years then sagebrush maybe near absent and represented only by younger age classes. Sulfur eriogonum very occasional. Horsebrush and green rabbitbrush are subordinate to sagebrush but are locally abundant as colonies with disturbance. Needlegrass, Ross sedge and squirreltail more common within shrub influence than in openings between shrubs. Older age classes of perennial bunchgrasses are strongly aggregated in burned and grazed stands. Perennial forbs as wooly eriophyllum, least lupine, lomatium, flax found within shrub influence. Forbs as hoary aster, Pursh locoweed, pussypaws, rockcress and pussytoes occur in shrub interspaces and may dominate over grasses. Annual forbs prevalent in interspaces but not so common under shrubs. Litter layer occurs beneath shrubs or within bunchgrass canopy.

Big sagebrush/ needlegrass in fair forage rating. Sagebrush cover is 15% Herbaceous production approximates 50 lb/acre dry weight. Lupine restricted to shrub canopy when present.

Poor: Green rabbitbrush and horsebrush are codominants with big sagebrush due to overgrazing. Sagebrush canopy may exceed 25%. Young sagebrush common on burned stands. Big sagebrush may be increasing with younger age classes apparent. Granitegila and sulfur eriogonum are usually absent. Bottlebrush squirreltail dominates over western needlegrass and Ross sedge. Perennial grasses and forbs tend to be aggregated toward the influence of shrub canopies. Recently burned stands have a preponderance of immature and young aged bunchgrass with older plants very much clumped. Interspaces between shrubs are occupied by hoary aster, pussypaws and annual forbs.

Big sagebrush/ needlegrass in poor forage rating. Mortality in sagebrush is common. Palatable grasses and forbs confined to shrub canopy. Herbaceous production is 35 lb/acre dry weight.

Very Poor: Green rabbitbrush and horsebrush dominant over big sagebrush. Portions of shrub stand is breaking up due to lack of shrub regeneration. Recently burned stands have sagebrush cover greater than 25-30% and age class distribution weighted toward young and immature plants. Western needlegrass, squirreltail and Ross sedge restricted to within canopy of big sagebrush. Perennial forbs scarce, mainly hoary aster and pussypaws found under shrub canopy influence. Interspaces dominated by annuals. Litter layer absent or very occasional under shrubs.

FORAGE COVER RATING

The use of the three-step method in this plant community rarely results in greater than 6 to 7 direct hits on herbaceous species per 100 feet of transect when shrub cover exceeds 15% in good forage rating. Direct hits on shrubs are used as an estimate of shrub canopy cover.

A maximum of 25 points is assigned to forage cover. The following table lists the point rating by the number of herbaceous decreaser and palatable increaser plant hits and shrub cover class averaged for a cluster of two or more transects.

	Number of Hits			
Shrub Cover:	0-5%	5-15%	16%+	Point rating
	9+	7+	6 +	20-25
	7-8	5-6	4-5	13-19
	5-6	3-4	2-3	6-12
	0-4	0-2	0-1	0-5

FORAGE COMPOSITION RATING

Forage composition is not significantly related to any particular environmental or stand characteristic within this plant community. Decreaser shrubs are included in the forage composition rating. Forage composition should be based upon herbaceous decreaser and palatable increaser species when fire has removed the shrub layer. Closest perennial sampling along three-step transects should include all shrubs when they occur.

A maximum of 65 points is assigned to forage composition. Forage composition rating is calculated by assigning one point for each percent composition of herbaceous and shrub decreasers and palatable herbaceous increasers. The resulting composition value is use to rate forage composition by entering the following table:

Calculated Composition Value	Composition Rating
70+	52-65
50-69	40-51
30-49	27-39
10-29	14-26
0-9	0-13

PLANT VIGOR INDEX

Plant vigor responds to annual weather patterns and grazing pressure. The following guide is used to rate the vigor that results from livestock grazing on a 10 point scale:

Description	Rating
Average maximum leaf or seed stalk length of mature bunchgrass plants exceeds 75% of potential for the site in the year sampled. Over 30% of plants are seedlings or immature individuals, decadence rare. This vigor exists on previously deteriorated range with maximum upward trend	9 - 10
Mortality of mature bunchgrass plants occasionally evident within some basal clumps. Root crowns intact, firmly rooted and show few signs of weakness. Average maximum leaf or seed stalk length between 51 and 75% of potential for the site in the year sampled. Less than a quarter of plants are seedlings or immature individuals. Less than 5% of mature plants are decadent; seedling decadence occasional. This vigor exists on previously deteriorated range which have received an extended period of rest and are approaching good forage rating	6 - 7 - 8
Mortality of mature bunchgrass plants evident within many clumps. Root crowns displaced with some effort, occasional pedestaling. Average maximum leaf or seed stalk length between 26 and 50% of potential for the site in the year sampled. Seedling of immature individuals less than 10 to 15% of plants present. Up to 15% of mature plants are decadent; seedling decadence is common. This vigor experienced in any rating class having from moderate down trend to no apparent trend	3 - 4 - 5

Description	Rating
Internal portions of mature bunchgrass plants clumps show much mortality. Root crowns usually pedestaled or weak and easily displaced. Seed stalks produced only under favorable climatic conditions. Average maximum leaf or seed stalk length less than 25% of potential for the site in the year sampled. Seedling or immature individuals not evident or very occasional. This vigor exists on deteriorated range with maximum down trend	0 - 2

FORAGE PRODUCTION

Forage production, excluding shrubs, averages 150 lbs/A air dry weight. Climate can give a 200% variation from one year to another. Native forage production can be doubled by removing the shrub layer by prescribed fire. Revegetation with domestic species is not recommended due to exceptionally coarse pumice soils.

SOIL STABILITY RATING

Soil stability is evaluated using two criteria, the amount of ground surface exposed and evidence of current soil erosion. Both criteria receive an equal weight of 50.

Bare Soil Index

The bare soil index is based on the number of transect hits on bare soil plus pavement, that is, all surface fragments less than 3/4 inch in diameter. Particle size distribution in pumice parent material makes it very difficult to separate bare soil coarse fragments from pavement sized fragments which result from accelerated erosion. Transect hits are averaged for a cluster. Bare soil rating is scored by the following table which is adjusted for central Oregon situations.

Bare Soil + Pavement Hits	Index
Less than 71	45-50
75 - 71	35-44
80 - 76	25-34
85 - 81	15-24
Greater than 85	0-14

Current Soil Erosion Index

The following criteria incorporate natural as well as erosion that is induced by grazing activities:

Description	Rating
No evidence of soil movement. Shrub interspaces support perennial forbs and grasses, litter and moss. Pumice pavement is present but discontinous. Pedestalling of perennials from frost heaving and not accelerated soil movement. Soil surface friable and porous, not compacted. Surface A1 horizon of dark color and not truncated. Trampling displacement not evident. Soil and pumice gravel deposition against obstructions caused by animal burrows or colluvial action and not water or air movement	41 - 50
Soil movement slight and local. Erosion confined to shrub interspaces. Shrub interspaces are invaded by annuals and young perennials. Moss and litter cover stablilized under shrubs but not interspaces. Plant pedestalling from frost heaving, not excessive soil erosion or trampling. Some litter and soil may be accumulated on upslope side of obstructions due to colluvial movement of pumice. Soil surface is porous and friable under shrubs, compacted in interspaces or localized areas. Slight evidence of trampling displacement. Sheet erosion light and only from severe storms. Excessive water floats pumice gravels on surface and may sort particle sizes	31 - 40
Soil movement moderate. Pumice pavement continuous and interconnected. Some concentration of pumice gravels in upper part of A1 horizon. Shrub interspaces partially occupied by young perennials. Litter restricted mainly to shrub understory. Trampling displacement occasional. Some buildup of windblown fine material may occur under shrubs. Compaction of pumice gravels within shrub interspaces	21 - 30
Soil movement advanced. Pumice pavement dominates but site influenced by vegetation. Large interspaces between shrubs are dominated by annuals and occasionally younger perennial plants. Litter layer confined to shrub understory. Moss absent under shrubs. Trampling displacement common. A1 surface soil horizon severely truncated. Current soil and pumice gravel movement not being effectively arrested by vegetative cover	11 - 20

Description	Rating
Soil movement severe. Bare soil and pumice gravels continuous and form the matrix within which perennials are growing. Interspaces between shrubs either lack vegetation or are dominated by annuals. Pedestalling of older grass plants common. Overland movement of pumice gravels occurs after severe summer storms	0 - 10

RECONNAISSANCE FORAGE AND SOIL RATING

The forage and soil rating of a sagebrush/needlegrass community can be approximated by systematically placing 20 to 30 one square foot microplots and ocular estimating the following attributes:

a. Average foliar cover aggregated for needlegrass and squirreltail.

b. Frequency of either needlegrass or squirreltail.

c. Average percent of bare soil plus pavement.

The average of the microplots is compared to the criteria listed below:

	Foliar cover		Frequency		%Bare soil
Shrub cover:	>15%	<15%	>15%	<15%	& pavement
Good	6%+	16%+	26%+	50%+	72%+
Fair	4-5	10-15	15-25	30-49	71-80
Poor	2-3	5-9	6-14	11-29	81-90
Very Poor	0-1	0-4	0-5	0-10	91-100

SPECIES LIST

Decreasers

Erum	Eriogonum umbellatum
Caro	Carex rossii
Sihy	Sitanion hystrix
Stoc	Stipa occidentalis

Increasers, Palatable

Lile	Linium lewisii
Loma	Lomatium martindalei

Increasers, Unpalatable

Artr	Artemisia tridentata
Chvi	Chrysothamnus viscidiflorus
Erba	Eriogonum baileyi
Erov	Eriogonum ovalifolium
Lepu2	Leptodactylon pungens
Teca	Tetradymia canescens
Andi	Antennaria dimorpha
Arho	Arabis holboellii
Asca	Aster canescens
Aspu	Astragulus purshii
Erla	Eriophyllum lanatum
Lemo	Leucocrinum montanum
Lule	Lupinus lepidis
Spum	Spraguea umbellata

Invaders

ANN	All annuals

SUMMARY STATISTICS OF THREE-STEP SAMPLES 1/

	Mean	95% CI	CV	N
Decreaser + Palatable Increaser Hits 2/	2.6	1.62	.71	5
Decreaser Hits	2.6	1.62	.71	5
Palatable Increaser Hits	(insufficient data)			
Decreaser + Palatable Increaser Comp. 3/	49.3	19.57	.45	5
Decreaser Composition	48.0	19.00	.45	5
Palatable Increaser Composition	2.1	1.28	.61	4
Total Hits (all plants)	4.7	2.07	.50	5
Species with 80% Presence:				
Artemisia tridentata				
composition	4.4	3.41	.88	5
crown cover, line intercept	17.7	4.96	.32	5
crown cover, loop frequency hits	11.2	7.48	.76	5
Eriogonum umbellatum				
composition	8.1	2.29	.63	5
crown cover, line intercept	.9	.37	.41	4
crown cover, loop frequency hits	1.9	.57	.34	5
Stipa occidentalis				
hits	2.0	.82	.47	5
composition	28.6	8.69	.35	5
Sitanion hystrix				
hits	data too variable			
composition	3.4	1.09	.33	5
Lupinus lepidus				
hits	1.5	.31	.24	5
composition	32.1	13.50	.48	5
Arabis hoboellii				
hits	data too variable			
composition	1.0	.31	.35	5
Litter	16.8	4.73	.32	5
Moss	1.3	.50	.44	5
Bare soil + Pavement	74.4	5.23	.08	5
Rock	2.8	1.06	.43	5

1/ Based on least disturbed stands. 95% CI: 19 out of 20 samples lie between ± stated confidence interval assuming a normal distribution. CV: coeff. of variation = std. deviation/mean. N = sample size.
2/ Excludes shrub direct hits.
3/ Includes shrubs in composition.

SUMMARY STATISTICS, RECONNAISSANCE RATING GUIDE
(1 sq. ft. Square Plot Data)

Attribute	Mean	95% CI	CV	N
Litter cover	20.1	6.77	.38	5
Bareground + pavement cover	77.1	6.55	.10	5
Rock cover	2.6	1.83	.80	5
Stipa occidentalis				
frequency	54.5	14.07	.29	5
foliar cover	2.6	.62	.54	5
Sitanion hystrix				
frequency	53.3	39.74	.65	4
foliar cover	1.4	1.55	1.26	5

Forage Rating Guide
for
PINE/SHRUB/FESCUE

(Includes Ecoclass: CPS1-11, CPS2-11, CPS2-16, CPS2-17, CPS3-14, CLS2-14, CLS1-11)

VEGETATION DESCRIPTION

This forage rating guide applies to those ponderosa and lodgepole pine plant communities which have Idaho fescue as the dominant herbaceous species. Associated shrub species can be big sagebrush, bitterbrush, greenleaf manzanita or snowbrush depending upon the specific community. Unpalatable shrubs as green and gray rabbitbrush or goldenweed increase after logging, burning or grazing disturbance along the shrub steppe ecotone and within the pumice flow deposit from Mt. Mazama.

Idaho fescue is only moderately palatable to livestock within this portion of Oregon. Adequate utilization of the species requires water hauling, fencing or herding. Fescue is resistant to both light underburning and skidding disturbance. Often fescue will dominate lightly scarified skidtrails or recent burns at the exclusion of shrubs. Historically natural underburning occurred on the average of once every 20 to 25 years (range: 6 to 50 years) within these communities. There has been an increase in both shrub and tree regeneration density since the 1920's when effective fire control was initiated. About 30 to 35 years is required to develop a fairly dense stand of shrubs or tree regeneration. Regeneration usually aggregates to openings in the residual tree overstory. Widely distributed regeneration is not common except immediately north of Spraque River and northerly aspects of Pine Mountain.

Ponderosa/fescue on stream terrace. Soils imperfectly drained in spring restrict bitterbrush to a weak subordinate position. Fair forage rating as result of tree crown closure.

Lodgepole/bitterbrush/fescue in good forage rating. Pine cover 57% and 160 sq. ft. basal area.

SITE DESCRIPTION

Early in the growing season (May and June) the lush forbs and increaser grasses found in association with fescue contribute much of the available forage; bitterbrush plays a more important role after mid July. Lower elevations have bluebunch wheatgrass, Sandberg bluegrass and prairie junegrass as subordinates to fescue on shallow, stony soils. Wheelers bluegrass and tailcup lupine are very common on Pine Mountain.

The forage guide is restricted to the pumice deposition zone of Deschutes, Fremont and Winema National Forests. Topography varies from steep to undulating slopes of buttes, escarpments, lava plateaus, terraces and outwash plains. The steepest slopes rarely exceed 50% and those being restricted to buttes and escarpments. Soils are derived from shallow, well-mixed pumice overlying a buried soil from basalt, andesite, tuff, glacial till or outwash. The buried soil is usually less than 30 inches below the soil surface. Soil profiles are characterized by a well mixed AC horizon lying directly over a buried soil. Occasionally these communities are found on geologically recent soil material which has been redeposited onto older surfaces. The discontinuities that exist between coarse-textured pumice and the buried profile slows water drainage early in growing season and favors Idaho fescue dominance on sites usually too xeric for the species.

Well mixed airborne pumice deposited over an older profile of basalt residuum. Rooting depth 25 inches. 1 dm = 4 inches.

Stands supporting greenleaf manzanita or snowbrush hold elevated positions in the local topography and escape the colder night temperatures during growing season. Most stands supporting Idaho fescue approach range readiness in May, the earliest of any forested communities within the pumice zone. The AC horizon usually reaches wilting point by mid-August.

FORAGE RATING

Forage rating is based upon 1) forage cover, 2) forage composition and 3) plant vigor. These descriptions generally apply to stands grazed by livestock which are in mid to late seral ecological status as defined in FSH 2209.21. Data is not available at this time for adequately rating early and very early ecological status. Shrub layer may be absent where stands are burned within last 15-20 years. In this case use herbaceous layer descriptions as indicators. A qualitative description for each of four rating classes follows:

Good: Bitterbrush with little or no hedging, all age classes represented. Shrub height varies considerably with site potential and not grazing history. Serviceberry, mountain-mahogany, western juniper, if present, no greater than a codominant. Rabbitbrushes or goldenweed as scattered, very subordinate individuals or small groups; not successfully occupying large areas. Manzanita or snowbrush not successfully regenerating itself where associated with bitterbrush. Idaho fescue well distributed, not pedestalled or with decayed centers. Interspaces between bunchgrasses with only occasional plants as western yarrow, antennaria, peavine, balsamroot, lupine, western needlegrass, squirreltail or Ross sedge. Annual forbs restricted to interspaces between bunchgrass clumps, abundant only in moist years.

Ponderosa/ bitterbrush/ bunchgrass in good forage rating. Bitterbrush, sagebrush and bunchgrasses well represented.

Fair: Bitterbrush represented by all age classes, can be somewhat aggregated due to tree closure. Big sagebrush, when present, usually dominates over bitterbrush. Rabbitbrush and goldenweed strongly subordinate, but restricted to sites disturbed by logging, burning or past overuse by livestock. Young plants of mountain-mahogany, western juniper or serviceberry found occasionally but not common. Idaho fescue well distributed, represented by all age classes but older, pedestalled plants are the most common. Western needlegrass, squirreltail and Ross sedge common but not dominant over fescue except on scarified microsites. Perennial forbs occur commonly as small colonies, most often within influence of a shrub canopy. Cheatgrass, if present, restricted to microsites of recent disturbance, as skidroads and landings or larger openings.

Ponderosa/bitterbrush-sagebrush/fescue small sawtimber stand with 65 sq. ft. basal area, 20% pine cover, 8% sage, 3% bitterbrush. Fair forage rating, predominance of sagebrush, fescue clumped to shrub understory, bitterbrush mortality high and distribution clumped.

Poor: Bitterbrush not evenly distributed but strongly clumped or as very widely scattered individuals; mainly represented by older age classes with little successful recruitment; can be heavily hedged. Mountain-mahogany and western juniper decadent, young plants of juniper may be common. Manzanita, snowbrush, rabbitbrush, goldenweed and big sagebrush aggressive on disturbed sites and usually occur as colonies represented by all age classes. Idaho fescue shows lack of young plants and has a preponderance of older, pedestalled, partially decadent plants. Fescue distribution may be interrupted by aggressive Ross sedge colonies especially on older skid trails. The more vigorous fescue is restricted to shrub canopies. Western needlegrass and squirreltail codominant with fescue and aggressively occupy recently disturbed areas. Perennial plants as western yarrow, lambstongue groundsel, phacelia, peavine, strawberry and fleabane are prevalent in absence of Idaho fescue competition. Annual forbs prevalent irrespective of cyclic moisture-temperature patterns.

Ponderosa/ bitterbrush/ fescue in poor forage rating due to logging and sheep grazing. Bitterbrush strongly grouped, fescue pedestalled and codominated with increasers.

Poor forage rating in ponderosa/bitterbrush/fescue showing pedestalling of fescue and exposure of interspaces.

Very Poor: Stand so disturbed by overgrazing that bitterbrush and Idaho fescue will not recover to satisfactory densities without artificial regeneration. Bitterbrush usually only an occasional plant, young plants rare and usually severely hedged. Big sagebrush, rabbitbrush or goldenweed predominate the stand except in dense tree canopies. Idaho fescue as localized small groups of poor vigor, most often found within influence of shrubs and not successfully seeding into openings. Fescue can be severely frost-heaved and show much decadence. Herbaceous layer dominated by western needlegrass, squirreltail and Ross sedge. Their foliar cover is variable due to stand treatment and tree canopy cover. Perennial forbs as infrequent large colonies. Annual forbs common.

FORAGE COVER RATING

The use of the three-step method in these plant communities results in less than 12 direct hits on herbaceous plants per 100 feet of transect in good forage rating. Direct hits on decreaser and palatable increaser herbaceous species are used in calculating a forage cover rating.

Decreaser plus palatable increaser hits are related to both shrub overstory cover and tree crown closure. Decreaser plus palatable increaser hits decrease 1.8% for each 10% increase in shrub cover when tree cover is less than 40%. Tree cover in excess of 40% adversely affects both shrub cover and direct hits of herbaceous plants. Adjustment for crown closure requires a line intercept estimate of tree and shrub crown along the same transect used to measure loop frequency for plant hits. Measure crown intercept of the tree overstory, tree understory and shrub overstory along the line using at least 200 feet of transect. The forage cover class is then adjusted downward to reflect the effects of canopy closure:

Tree Crown Intercept	Forage Cover Class
Tree cover 0-40%	
Shrub cover 0-10%	9
Shrub cover 11-20%	6
Shrub cover 21%	3
Tree cover 41%+	3

A maximum of 25 points is assigned to forage cover. The following table lists the number of points by Forage Cover Class according to the number of decreaser and palatable increaser herbaceous plant hits averaged for a cluster of two or more transects. Determine the number of plant hits than refer to the cover class suggested by tree and shrub cover estimates and interpolate points based upon experienced plant hits.

Number of Hits	Point Rating by Cover Class		
	9	6	3
9 - 11	25		
6 - 8	19	25	
3 - 5	12	16	25
0 - 2	6	8	13

FORAGE COMPOSITION RATING

Forage composition is affected by both tree cover and stand basal area. Decreaser + palatable increaser composition (including shrubs) decreases roughly 3.2 points for every 1% increase in tree crown cover over 40%, and decreases 6.4 points for every 10 sq. ft. increase in stand basal area over 135 sq. ft. Equations are given for these relationships in the Summary Table.

Open grown ponderosa pine/ bitterbrush/ fescue in good forage rating. Tree basal area is 75 sq. ft. and cover is 20%.

Immature stand of ponderosa/bitterbrush/fescue in good forage rating. Tree basal area is 135 sq. ft. and 30% cover. Fescue and bitterbrush aggregate to openings in tree overstory.

Adjustment in forage composition for crown closure and basal area requires an estimate for each attribute along the same transects used to determine forage composition. Measure crown intercept of the tree overstory plus tree understory along the line using at least 200 feet of transect. Tree basal area is measured with a calibrated 10 factor prism at each transect stake using at least six sample points and averaging the estimates.

A maximum of 65 points is assigned to forage composition. Shrubs classified as decreasers are included in forage composition rating. Therefore, sampling closest perennials along the three-step transects should include all shrubs in the composition. A sum of the percent composition in herbaceous and shrub decreasers and percent composition in herbaceous palatable increasers is used to rate forage composition. Do not count herbaceous palatable increaser composition in excess of 35 percent.

Pole stand of Ponderosa/bitterbrush/fescue in good forage rating. Tree basal area prior to thinning was 135 sq. ft. with 55% cover. Fescue and bitterbrush strongly aggregated to openings.

Forage composition may be adjusted for the effects of tree cover and stand basal area. The following table lists the calculated forage composition value adjusted by tree cover and basal area category. Enter the table at the calculated composition column and determine the points from the rightmost column. If calculated composition exceeds the limits placed on either basal area or tree cover refer to the next highest class.

Tree Cover:	0-35%	36-45	46-55	56+	Composition
Basal Area:	0-120 ft^2	121-140	141-150	151+	Point
Limit					Rating
	81-100	73-90	57-70	41-50	53-65
	61-80	55-72	43-56	31-40	40-52
	41-60	35-54	29-42	21-30	27-39
	21-40	19-36	15-28	11-20	14-26
	0-20	0-18	0-14	0-10	0-13

Maximum Limit:
35% pal. incr. composition

PLANT VIGOR RATING

Plant vigor responds to annual weather patterns, grazing pressure as well as tree crown closure. The following guide is use to rate the vigor that results from livestock grazing on a 10 point scale:

Description	Rating
Average maximum leaf or seed stalk length of mature bunchgrasses exceeds 75% or seasonal potential as indicated from ungrazed plants. Over 30% of plants are seedlings or immature individuals; decadence rare. Mature bitterbrush have vigorous current twigs, seedlings and immature shrub plants common. This vigor exists only in deteriorated range in maximum upward trend	9 - 10
Mortality of mature bunchgrass plants occasionally evident within some basal clumps. Root crowns intact, firmly rooted and show few signs of weakness. Average maximum leaf or seed stalk length between 51 and 75% of seasonal potential as indicated from ungrazed plants. Less than a quarter of plants are seedlings or immature individuals. Less than 5% of mature plants are decadent. Bitterbrush have very few if any decadent branches. This vigor exists on deteriorated range in up trend range approaching good forage rating	6 - 7 - 8
Mortality of mature bunchgrass plants evident within many clumps. Root crowns displaced with some effort, occasional pedestaling. Average maximum leaf or seed stalk length between 26 and 50% of seasonal potential. Seedling or immature individuals less than 10 to 15% of plants present. Up to 15% of mature plants are decadent; seedling decadence is common. Sagebrush, if present, is vigorous and has 5 to 15% young plants, at least in tree openings. Tree cover exceeding 40% is affecting vigor and distribution of most shrubs. Bitterbrush showing some decadent branches and individuals. Stand recruitment about averages mortality. This vigor is experienced in any forage rating class having from moderate down trend to no apparent trend	3 - 4 - 5

Description	Rating
Internal portions of mature bunchgrass clumps show much mortality. Root crowns usually pedestaled or weak and easily displaced. Seed stalks produced only under favorable climatic conditions. Average maximum leaf or seed stalk length less than 25% of seasonal potential. Seedling or immature individuals not evident or very occasional. Bitterbrush showing much decadence in crown as well as individuals from grazing and/or tree canopy closure. Sagebrush in excellent vigor in tree opening, when present, with more than 15% young plants. Undesirable plants as cheatgrass, rabbitbrush, goldenweed are spreading. This vigor exists on deteriorated range with maximum down trend	0 - 2

FORAGE PRODUCTION

Native forage production (excluding shrubs) averages 174 lbs/A air dry weight ± 26 lbs with an experienced range of 80 to 350 lbs. under good forage rating depending upon slope steepness and yearly climatic variations. Climate alone can give a 200% variation from one year to another. Production tends to be less on slopes exceeding 10%. Herbaceous production is strongly influenced by tree overstory basal area; as basal area increases production decreases. A regression equation is given for this relationship in the Summary Table.

SOIL STABILITY RATING

Soil condition is evaluated using two criteria, the amount of ground surface exposed and evidence of current soil erosion. Both criteria receive an equal weight of 50.

Bare Soil Index

The bare soil index is based on the number of transect hits on bare soil plus pavement, that is, all surface fragments less than 3/4 inch in diameter. Particle size distribution in pumice parent material makes it very difficult to separate bare soil coarse fragments from pavement-sized fragments which result from accelerated erosion. Transect hits are averaged for a cluster. Bare soil attributed to logging is added to naturally occurring bare soil hits. Bare soil rating is then scored by the following table which is adjusted for central Oregon situations:

Bare Soil + Pavement Hits	Index
Less than 9	45 - 50
20 - 9	35 - 44
30 - 21	25 - 34
40 - 31	15 - 24
Greater than 40	0 - 14

Bare soil is normal for these communities, under stable conditions bare soil rarely exceeds 10-15%.

Current Soil Erosion Index

The following criteria incorporate natural as well as erosion induced by logging and grazing activities:

Description	Rating
No evidence of soil movement. Bare spaces small and well dispersed. Interspaces between bunchgrasses occupied by young perennial forbs, grasses or litter. Pedestalling of perennials and rock fragments from frost heaving and not accelerated soil movement. Soil surface friable and porous, not compacted. Trampling displacement not evident. No active rills or gullies on slopes. Soil deposition from animal burrows or colluvial action and not water or air movement. Logging disturbance is completely healed. Litter layer almost continuous under tree canopy	41 - 50
Soil movement slight and local. Erosion confined to individual bare spaces. Larger interspaces are invaded by perennials. Moss cover stabilized under shrubs. Plant pedestalling from frost heaving, not excessive soil erosion or trampling. Some litter and soil may be damed on upslope side of bunchgrass due to colluvial movement and soil creep. Soil surface usually porous and friable, being compacted only in interspaces or localized areas. Little evidence of trampling displacement. Sheet erosion light and only from severe storms. Slight cupping out below bunchgrasses from wind action. Logging disturbance is well covered with needle litter, increaser or invader plants stabilizing scarified soil surfaces	31 - 40
Soil movement moderate. Bare spaces or erosion pavement continuous and interconnected. Interspaces between bunchgrasses partially occupied by young perennials or patches of litter. Plant pedestals due to soil movement, frost heaving, or grazing. Soil and plant displacement occurs from grazing animals. Cupping out below bunchgrasses on steeper slopes. Compaction within interspaces evident on flatter ground. Some soil mounds may occur under shrubs. Lichen lines barely evident on large embedded rocks. Current soil movement occurs in bare soil openings and rodent colonies. Logging disturbance is less than 20% of the area. The presence of recent logging places one in this category due to risk of future erosion	21 - 30

Description	Rating
Soil movement advanced. Bare soil, surface rock fragments or pavement dominate but site still influenced by vegetation and litter. Large interspaces between perennials are occupied by annuals and occasionally younger perennial plants. Litter layer is lacking in most interspaces and confined to shrub or grass understories. Pedestals common from partial loss of A1 surface soil horizon or trampling displacement. Heaving and crusting of soil surface common. Current soil movement not being effectively arrested by vegetation or litter cover. Active soil movement on skid trails and landings, as a result of livestock grazing or logging. Rills and gullies apparent or more than 20% of area denuded disturbed by logging activity	11 - 20
Soil movement severe. Bare soil or surface rock fragments continuous and form the matrix within which colonies of perennials are growing. Interspaces between perennial plants lack vegetation or dominated by annuals. Litter layer usually absent or confined to immediate influence of perennial plants. Soil compaction may exceed 3 to 5 inch depth on flatter ground. Debris dams and excessive soil buildup against obstructions on steeper slopes. Plant pedestals and cupping out of perennials common. Lichen lines on large embedded rocks are obvious and elevated more than 2 inches above surrounding soil. Overland movement of soil evident, deposition evident from air or water erosion. Coarse textured subsoils and bedrock are exposed in places. Skid trails are deeply gullied which may extend to buried soil profile. Site potential on logging disturbance has probably changed permanently due to soil loss and vegetation cannot reach potential of good using this standard	0 - 10

RECONNAISSANCE FORAGE AND SOIL RATING

The forage and soil rating of a fescue-dominated plant community can be approximated by using a 9.6 sq. ft. circular plot or a 1 sq. ft. square plot and estimating one of the following attributes:

a. The average crown cover of herbaceous decreaser plants.

b. The average number (density) or frequency of decreaser plants.

c. The average percentage of bare soil + pavement.

At least ten 9.6 sq.ft. circular plots or 20 to 30 one sq. ft. square plots should be systematically placed after a random start is used. The average of the plots is compared to the criteria listed below. These criteria apply to stands with less than 40% tree crown cover. One square foot plot criteria are in parenthesis. For stands which have greater than 40% tree cover reduce the crown criteria of decreaser plants listed for 9.6 sq. ft. data by 3% for each 10% increase in tree cover over 40% then enter forage guide at the class interval.

Herbaceous Decreaser Plants

Rating Class	% Cover	Density	% Freq.	% BS + Pavement
Good	15% + (10%+)	6 + (.8+)	(60% +)	0-12 (0-4)
Fair	10-14 (5-9)	3-5 (.4-.8)	(31-60)	13-30 (5-20)
Poor	4-9 (1-4)	1-2 (.1-.3)	(11-30)	31-50 (21-35)
Very Poor	(No significant decreasers)		(0-10)	50 + (36+)

SPECIES LIST

Decreasers

Amal	Amelanchier alnifolia
Putr	Purshia tridentata
Agcr	Agropyron cristatum
Agin	Agropyron intermedium
Agsp	Agropyron spicatum
Kocr	Koleria cristata
Feid	Festuca idahoensis
Baca	Balsamorhiza careyana
Crac	Crepis acuminata
Lile	Linum lewisii
Sein	Senecio intergerrimus
Trma	Trifolium macrocephalum

(With Game Use)

Cele	Cerocarpus ledifolius
Erum	Eriogonum umbellatum
Liru	Lithospermum ruderale
Pone2	Poa nevadensis

Increasers, Palatable

Rice	Ribes cereum
Cape5	Carex pensylvanica
Caro	Carex rossii
Agda	Agropyron dasystachyum
Brca	Bromus carinatus
Brvu	Bromis vulgaris
Daun	Danthonia unispicata
Posa	Poa sandbergii
Pole2	Poa leibergii
Powh	Poa wheeleri
Sihy	Sitanion hystrix
Stoc	Stipa occidentalis
Stth	Stipa thurberiana
Lala2	Lathyrus lanswertii

(With Game Use)

Erhe	Eriogonum heracleoides
Aggl	Agoseris glauca
Loma	Lomatium martindalei
Lotr	Lomatium triternatum

Increasers, Unpalatable

Arpa	Arctostaphylos patula
Artr	Artemisia tridentata
Ceve	Ceanothus velutinus
Chna	Chrysothamnus nauseosus
Chvi	Chrysothamnus viscidiflorus
Erhe	Eriogonum heracleoides
Erum	Eriogonum umbellatum
Habl	Haplopappus bloomeri
Lepu2	Leptodactylon pungens
Acmi	Achillea millefolium
Anco2	Antennaria corymbosa
Andi	Antennaria dimorpha
Anro	Antennaria rosea
Arco	Arnica cordifolia
Arpl	Arabis platysperma
Astra	Astragulus spp.
Cali	Castilleja linariaefoli
Cice	Cirsium centaureae
Epan	Epilobium angustifolium
Denu3	Delphinium nuttallianum
Erfi	Erigeron filifolius
Erla	Eriophyllum lanatum
Frat	Fritillaria atropurpurea
Frvi	Fragaria virginiana
Hial	Hieracium albiflorum
Hisc	Hieracium scouleri
Hofu	Horkelia fusca
Kega	Kelloggia galioides
Lemo	Leucocrinum montanum
Lule2	Lupinus lepidus
Luca	Lupinus caudatus
Mial2	Microseris alpestris
Mope	Montia perfoliata
Peci	Penstemon cinicola
Pehu	Penstemon humilis
Seca	Senecio canus
Vipu	Viola purpurea

Invaders

ANN	Annual forbs
Brte	Bromus tectorum
Zive	Zigademus venenosus (poisonous)

SUMMARY STATISTICS OF THREE-STEP SAMPLES 1/

	Mean	95% CI	CV	N
Decreaser + Palatable Increaser Hits 2/	5.5	.78	.47	42
Decreaser Hits	4.8	.37	.49	42
Palatable Increaser Hits	1.1	.28	.70	27
Decreaser + Palatable Increaser Comp 3/	90.2	2.02	.07	42
Decreaser Composition	68.0	4.24	.20	42
Palatable Increaser Composition	22.2	4.08	.61	42
Total Hits (all plants)	5.7	.86	.49	42
Species with 80% Presence:				
Purshia tridentata				
composition	7.0	1.74	.81	40
crown cover (loop frequency)	14.5	3.00	.66	40
Festuca idahoensis				
hits	4.4	.64	.47	40
composition	54.6	5.02	.30	42
Agropyron spicatum				
hits	2.4	1.37	.65	5
composition	23.0	10.04	.58	7
Stipa occidentalis				
hits	.8	.18	.39	12
composition	11.5	3.15	.84	37
Sitanion hystrix				
hits		(data variable)		
composition	4.5	1.36	.97	40
Carex rossii				
hits	.8	.28	.73	14
composition	4.2	1.06	.79	39
Litter	80.0	5.28	.22	42
Moss	2.3	.78	.89	27
Bare soil + Pavement	8.8	2.71	1.00	41
Rock	4.5	3.48	1.76	20

1/ Based on least disturbed stands with less than 40% tree crown cover. 95% CI: 19 out of 20 samples lie between ± stated confidence interval assuming a normal distribution. CV: coefficient of variation = std. deviation/mean. N: sample size.

2/ Excludes shrub direct hits.

3/ Includes shrubs in composition but they rarely exceed 10%.

SUMMARY STATISTICS, RECONNAISSANCE RATING GUIDE
(9.6 sq. ft. Circular Plot Data)

Attribute	Mean	95% CI	CV	N
Litter cover	88.3	4.21	.14	34
Bare soil + pavement cover	9.3	3.19	1.00	33
Rock cover	4.3	3.98	2.14	21
Festuca idahoensis				
density	6.1	.94	.45	33
Agropyron spicatum				
density	2.1	.81	.49	6
Stipa occidentalis				
density	1.6	.49	.80	26
foliar cover	1.6	.76	1.10	22
Sitanion hystrix				
density	1.1	.71	1.14	13
foliar cover	1.1	.56	.79	9
Carex rossii				
density	.5	.18	.48	8
foliar cover	.7	.32	.71	8

(1 sq. ft. Square Plot Data)

Attribute				
Litter cover	91.9	2.83	.08	28
Bare soil + pavement cover	6.1	2.55	1.14	28
Rock cover	1.3	1.21	2.13	21
Festuca idahoensis				
density	.9	.16	.33	15
frequency	64.2	6.40	.23	21
foliar cover	12.1	2.15	.40	20
Stipa occidentalis				
frequency	16.1	5.20	.79	23
foliar cover	.9	.32	.82	20
Sitanion hystrix				
frequency	7.1	2.23	.71	20
foliar cover	(data not available)			
Carex rossii				
frequency	8.8	2.70	.66	18
foliar cover	.9	.33	.72	14

PREDICTION EQUATIONS

1. Decreaser + Palatable Increaser Plant Hits (including shrub overstory) = 20.99 - .2805 (% tree overstory intercept)
   F = 28.95 with 1 and 43 degrees of freedom
   R^2 = .402
   Sy.x = 5.41 Equation limits: 10 to 60% tree cover

2. Decreaser + Palatable Increaser Composition = 227.84 - 3.26 (% tree overstory intercept)
   F = 57.1 with 1 and 14 degrees of freedom
   R^2 = .803
   Sy.x = 9.69 Equation limits: 40 to 60% tree cover

3. Decreaser + Palatable Increaser Composition = 82.83 + 1.246 (% tree cover) - .0316 (% tree cover squared)
   F = 41.35 with 1 and 55 degree of freedom
   R^2 = .634
   Sy.x = 8.82 Equation limits: 10 to 60% tree cover

4. Decreaser + Palatable Increaser Composition = 163.72 - .6426 (stand basal area)
   F = 5.36 with 1 and 16 degrees of freedom
   R^2 = .251
   Sy.x = 18.41 Equation limits: 120 to 160 sq. ft.

5. Decreaser + Palatable Increaser Composition = 75.04 + .4548 (stand basal area) - .0033 (stand basal area squared)
   F = 10.28 with 1 and 55 degrees of freedom
   R^2 = .359
   Sy.x = 12.16 Equation limits: 30 to 160 sq. ft.

6. Reconnaissance % Decreaser Cover = 24.08 - .3017 (% tree overstory intercept)
   F = 7.78 with 1 and 21 degrees of freedom
   R^2 = .270
   Sy.x = 3.49 Equation limits: 38 to 60% tree cover

7. Herbaceous Production = 414.3 - 4.75 (basal area) + .0176 (basal area squared)
   F = 6.98 with 3 and 38 degrees of freedom
   R^2 = .521
   Sy.x = 58.6 lbs. Equation limits: 20 to 140 sq. ft.

F = F statistic for testing significance of the equation.
R^2 = coefficient of determination, measures the amount of variation contained in test data that is accounted for by the equation.
Sy.x = standard error of estimate of sample mean for dependent variable, gives one standard deviation around mean of dependent variable. One standard deviation includes about 2/3rds of the population variation.

Forage Rating Guide
for
PINE/SHRUB/NEEDLEGRASS

(Includes Ecoclass: CLS2-13, CLS2-11, CLS2-15, CPS2-12
CPS2-13, CPS3-11, CWS1-14)

VEGETATION DESCRIPTION

This guide applies to those ponderosa pine and lodgepole pine plant communities which have western needlegrass, bottlebrush squirreltail, and Ross sedge as dominant herbaceous species and bitterbrush as the most common shrub species. Associated shrubs can be mountain-mahogany and squaw currant. Greenleaf manzanita may occur in close proximity to cinder cones and escarpments. Goldenweed is common on outwash sand, Newberry rhyolite pumice, and within the pumice flow deposit from Mt. Mazama. Stands toward the northern end of Deschutes NF contain many forbs. Species composition is more depauperate on coarse pumice soils to the south and east. These communities usually border fescue-dominated stands at lower elevations and manzanita or snowbrush sites on more elevated topography.

Ponderosa/ bitterbrush/ needlegrass with infusion of lodgepole pine as a result of fire control. Shallow pumice soils in this area permit establishment of natural tree regeneration and will eventually impact the ground vegetation via crown closure.

Typical over-mature stand of Lodgepole/ bitterbrush/ needlegrass which provides midseason sheep and deer browse but little herbaceous forage for cattle.

Western needlegrass, squirreltail, and Ross sedge increase appreciably from logging disturbance or burning. Native herbaceous production is increased two to three times by lightly disturbing the soil surface by logging scarification or underburning. Since undisturbed production is below 50 lbs/acre these communities are best used as transitory range for livestock. Needlegrass, squirreltail and Ross sedge function as palatable increasers under mid to late season grazing and as decreasers when utilization occurs prior to mid July. Bitterbrush is susceptible to browsing by livestock or deer and is easily killed by underburning during summer or autumn months. Early spring burning with high soil or fine fuel moisture is less detrimental to this shrub. Natural underburning has historically occurred on the average of once every 10 to 45 years (averages 30 years $\pm$ 14.0) within these communities. There has been an increase in both shrub and tree regeneration density since the 1920's when effective fire control was initiated. Bitterbrush will dominate the stand within 25 years following a burn and within 15 years following moderate to heavy site scarification from logging. Bitterbrush is tolerant of cold temperatures but not water saturated soils. Stands which have greenleaf manzanita or snowbrush hold elevated positions in the local topography and escape the colder night temperatures during the growing season. Goldenweed, an unpalatable shrub, strongly increases following logging or as a result of overgrazing. Additional carrying capacity is lost from expansion of lodgepole pine into ponderosa pine sites following logging or burning. Most lodgepole pine stands provide transitory range since forage production and access is limited when pole and small sawtimber size classes predominate.

Most stands approach range readiness by early June within the pumice zone. Available forage comes from bitterbrush after mid July and the lush forbs and grasses earlier in the growing season.

SITE DESCRIPTION

This guide is restricted to the pumice deposition zone of Deschutes, Fremont, and Winema National Forests. Topography is usually flat to convex undulating slopes of plateaus, benches, and basins. The steepest slopes rarely exceed 30%. Soils are derived from cindery to ashy airlaid pumice or pumice flow over a buried soil from basalt, andesite, tuff, glaced till or outwash. Depth to the buried soil varies considerably over the pumice deposition, less than 12 inches toward north and eastern end to over 100 inches near Crater Lake. Soil profiles have a distinctive A1, AC, C horizon sequence. A seasonally perched water table may occur in some lower slope positions. Occasionally these communities are found on more recent soil material which has been redeposited onto older soil profiles. The AC horizon usually reaches wilting point by mid July or early August.

A typical soil profile derived from air-laid dacite pumice. Majority of tree and shrub rooting occurs within upper 24 inches of profile. Dark surface horizon is the A1. 1 dm = 4 inches.

FORAGE RATING

Forage rating is based upon 1) forage cover, 2) forage composition, and 3) plant vigor. These descriptions generally apply to stands in mid to late seral ecological status as defined in FSH 2209.21. Data are not available at this time for adequately rating early and very early ecological status. A qualitative description for each of four classes follows:

Good: Bitterbrush well distributed across stand, all age classes represented. Shrub height a function of site potential rather than grazing pressure. Goldenweed or greenleaf manzanita as scattered, very subordinate individuals or small groups; not successfully occupying large areas. Western needlegrass, squirreltail and Ross sedge well distributed, not pedestalled or with decayed centers, all age classes represented. Perennial and annual forbs are well distributed across interspaces between shrubs.

Ponderosa/ bitterbrush/ needlegrass in good forage rating. Bitterbrush well distributed. Tree basal area 85 sq. ft. and crown cover 25%. Shrub cover is 28%.

Closeup of good forage rating Ponderosa/ bitterbrush/ needlegrass showing litter cover and depauperate nature of herbaceous vegetation.

Fair: Bitterbrush may be moderate to heavily hedged from past browsing pressure but represented by all age classes, can be somewhat aggregated due to tree closure or skidding disturbance. Goldenweed, greenleaf manzanita or snowbrush may be strong subordinates but restricted to disturbed sites. Young plants of mountain-mahogany or squaw currant occasionally found. Western needlegrass, squirreltail, and Ross sedge very common, may have a perponderance of one age class. Perennial and annual forbs occur commonly as small colonies, most often being restricted to shrub canopy.

Ponderosa/ bitterbrush/ needlegrass in fair forage rating. Distribution of bitterbrush affected by past logging. Young bitterbrush plants common. Increaser grasses dominate openings due to site scarification.

Poor: Bitterbrush not evenly distributed but strongly clumped or as very widely scattered individuals, may be heavily hedged from continued browsing pressure, mainly represented by older age classes with little successful recruitment. Mountain-mahogany and squaw currant decadent. Goldenweed aggressive locally on recently disturbed sites and usually occurs as colonies represented by all age classes. Western needlegrass, squirreltail, and Ross sedge aggressively occupy recently disturbed areas from logging or burning. Under early summer livestock use these grasses thin in density and cover, become characterized by one age class with a clumped distribution and individual plants of poor vigor. Perennial forbs scarce and restricted to shrub canopies. Annual forbs prevalent irrespective of cyclic moisture-temperature patterns.

Lodgepole/ bitterbrush/ needlegrass in fair to poor forage rating. Bitterbrush strongly clumped from logging activity and not successfully regenerating. Increaser plants dominate but pattern clumped.

Very Poor: The stand is so disturbed by overgrazing that bitterbrush or squaw currant will not recover to satisfactory densities without artifical regeneration. Bitterbrush and squaw currant usually only as an occasional plant, young plants rare and die prematurely. Goldenweed may predominate the stand except in dense tree canopies. Western needlegrass and squirreltail exceptionally common after soil disturbance from logging or burning. Distribution of both grasses is sparce and clumped under early summer livestock grazing lack recruitment. Individual plants usually weak, often pedestalled. Ross sedge usually declines under continued heavy grazing pressure. Perennial forbs occur as infrequent large colonies. Annual forbs as Linanthus, Crypthania, Collinsia, and Scutellaria are common.

Ponderosa/ bitterbrush/ needlegrass in very poor forage rating as result of intensive cattle use following tree harvest. Annual forbs dominate. Herbaceous production is 40 lb/acre dry weight.

FORAGE COVER RATING

Use of the three-step method in these plant communities rarely results in greater than 5 direct hits on herbaceous plants per 100 feet of transect in good forage rating. Direct hits on decreaser and palatable increaser herbaceous species are used in calculating a forage cover rating.

Decreaser and palatable increaser herbaceous hits are related to both shrub overstory cover and tree crown closure. Tree cover in excess of 20% adversely affects both shrub cover and direct hits on herbaceous plants. Adjustment for crown closure requires a line intercept estimate of tree and shrub crown along the same transect used to measure loop frequency for plant hits. Measure crown intercept of tree overstory, tree understory and shrub overstory along the line using at least 200 feet of transect. The forage cover class is then

adjusted downward to reflect the effects of canopy closure. Another influence on palatable increaser plants is site disturbance. Palatable increaser herbaceous plants will increase slightly with site disturbance from logging, grazing or burning. In these cases use the site scarification criteria as given below.

	Forage Cover Class
Tree cover 0 to 30%	
Site scarified	9
Site not scarified	
Shrub cover 0 to 10%	6
Shrub cover greater than 10%	3
Tree cover greater than 30%	1

A maximum of 25 points is assigned to forage cover. The following table lists the number of points given forage cover according to the number of decreaser and palatable increaser herbaceous hits averaged for a cluster of two or more transects.

Number of hits	Point Rating by Forage Class			
	9	6	3	1
9 or greater	25			
6 to 8	19	25		
3 to 5	12	16	25	
0 to 2	6	8	13	25

Lodgepole/ bitterbrush/ needlegrass with 25% tree cover and 20% shrub cover.

Lodgepole/ bitterbrush/ needlegrass which has been clearcut and site scarified by machine. Shrub cover approximates 1 to 2%.

Lodgepole/ bitterbrush/ needlegrass with 45% tree crown cover. Stand is 85 years of age. Crown closure has affected density of shrubs and herbaceous vegetation.

ORAGE
OMPOSITION
ATING

Forage composition within these communities appears unaffected by either tree cover less than 60% or stand basal area less than 200 square feet. Shrubs classified as decreasers are included in the forage composition rating. Therefore, sampling closest perennials along three-step transects should include shrubs in the closest perennial composition.

A maximum of 65 points is assigned to forage composition. Assign one point for each percent composition of herbaceous and shrubby decreasers. Limits are set on the composition of decreasers and palatable increasers. Do not count more than 40% composition of western needlegrass, 15% composition of Ross sedge, 5% composition of bottlebrush squirreltail. A maximum of 40% composition is given to decreaser shrubs. This rates down stands with an excessively dense shrub component or stands highly disturbed via management practices other than livestock grazing.

Assign one point for each percent composition of decreasers and palatable increasers within these limits. A sum of the points for decreasers and palatable increasers is used to rate forage composition by finding the points in the left column and reading the appropriate composition rating on the right column:

Calculated Composition Points	Composition Rating
81 - 100	53 - 65
66 - 80	40 - 52
51 - 65	27 - 39
36 - 50	14 - 26
0 - 35	0 - 13

Maximum Limits:

40% decreaser shrubs
40% western needlegrass
15% Ross sedge
5% squirreltail

PLANT VIGOR RATING

Plant vigor responds to annual weather patterns, grazing pressure as well as tree crown closure. The following guide is used to rate plant vigor that results from livestock grazing on a 10 point scale:

Description	Rating
Average maximum leaf or seed stalk length of mature bunchgrass exceeds 75% of seasonal potential when compared to ungrazed plants for year sampled. Over 30% of plants are seedlings or immature individuals; decadence rare. Mature bitterbrush have vigorous twigs even though plants are hedged. Seedlings and immature plants common. This vigor exists only on deteriorated range in maximum upward trend	9 - 10
Mortality of mature bunchgrass plants occasionally evident within some basal clumps. Root crowns intact, firmly rooted and show few signs of weakness. Average maximum leaf or seed stalk length between 51 and 75% of seasonal potential when compared to ungrazed plants for year measured. Less than a quarter of plants are seedlings or immature individuals. Less than 5% of mature plants are decadent, seedling decadence occasional. Bitterbrush seedlings and immature plants well represented but not common. This vigor exists on deteriorated range in up trend or range approaching good forage rating	6 - 7 - 8
Mortality of mature bunchgrass plants evident within many clumps. Root crowns displaced with some effort, occasional pedestaling. Average maximum leaf or seed stalk length between 26 and 50% of seasonal potential. Seedling or immature individuals less than 10 to 15% of plants present. Up to 15% of mature plants are decadent; seedling decadence is common. Bitterbrush showing some decadent branches and individuals, stand recruitment about averages mortality. This vigor experienced in any condition class having from moderate down trend to no apparent trend	3 - 4 - 5

	Description	Rating
	Internal portions of mature bunchgrass clumps show much mortality. Root crowns usually pedestaled or weak and easily displaced. Seed stalks produced only under favorable climatic conditions. Average maximum leaf or seed stalk length less than 25% of seasonal potential when compared to ungrazed plants for year measured. Seedling or immature individuals not evident or very occasional. Bitterbrush showing much decadence in crown as well as individuals, very few seedlings evident. Current years twigs short compared to caged shrub leader growth. This vigor exists on deteriorated range with maximum down trend	0 - 2

FORAGE PRODUCTION

Forage production, excluding shrubs, averages 12 pounds/acre air dry weight with an experienced range of 2 to 40 pounds under good forage rating. Production in these communities is not strongly influenced by tree overstory, stand basal area or easily measured soil attributes. Native herbaceous production can be doubled or tripled via lightly disturbing the soil surface as that which occurs during logging scarification or underburning. These communities are best considered as transitory range for livestock. Transitory range requires close coordination of grazing with timber stand improvement activities. The majority of deer and sheep forage comes from bitterbrush. Although no estimates of browse production are available, bitterbrush is weakly correlated with tree crown cover and stand basal area. Bitterbrush density is reduced in stands having tree canopy cover in excess of 40% and/or stand basal areas exceeding 135 square feet per acre. Browse in managed stands is more abundant within the first 20 years of the rotation and then again when trees achieve large sawtimber status. Stands in pole stands and small sawtimber provide little forage except along skid roads and landings.

SOIL STABILITY RATING

Soil stability is evaluated using two criteria, the amount of ground surface exposed and evidence of current soil erosion. Both criteria receive an equal weight of 50.

Bare Soil Index

The bare soil index is based on the number of transect hits on bare soil plus pavement, that is, all surface fragments less than 3/4 inch in diameter. Particle size distribution in pumice parent material makes it very difficult to separate bare soil coarse fragments from pavement sized fragments which result from acclerated erosion. Transect hits are averaged for a cluster. Bare soil rating is scored by the following table which is adjusted for central Oregon situations.

Bare Soil + Pavement Hits	Index
Less than 12	45-50
25-12	35-44
39-26	25-34
53-40	15-24
Greater than 53	0-14

Some bare soil is normal for these communities. Under stable conditions bare soil rarely exceeds 15%. Bare soil attributed to logging is added to naturally occuring bare soil hits.

Current Soil Erosion Index

The following criteria incorporate natural as well as erosion induced by logging and grazing activities:

Description	Rating
No evidence of soil movement. Bare spaces small and well dispersed. Interspaces between shrubs and bunchgrasses occupied by young perennial forbs, grasses, or litter. Pedestalling of perennials and rock fragments from frost heaving and not acclerated soil movement. Soil surface spongy to walk, not compacted. Trampling displacement not evident. No active rills or gullies on slopes. Soil deposition from animal burrows or colluvial action and not water or air movement	41 - 50
Soil movement slight and local. Erosion confined to individual bare spaces. Larger interspaces are invaded by perennials. Moss cover stabilized under shrubs. Plant pedestalling from frost heaving, not excessive soil erosion or trampling. Some litter and soil may accumulate on upslope side of logs, shrubs or bunchgrasses due to colluvial movement and soil creep. Soil surface usually porous and friable, being compacted only in interspaces or localized areas. Little evidence of trampling displacement. Sheet erosion light and results only from severe storms. Slight cupping out below bunchgrasses from wind action	31 - 40

Description	Rating
Soil movement moderate. Bare spaces or erosion pavement continuous and interconnected. Interspaces between bunchgrasses partially occupied by young perennials or patches of litter. Plant pedestals due to soil movement, frost heaving or grazing. Soil and plant displacement from grazing animals. Cupping out below bunchgrasses on steeper slopes. Compaction within interspaces evident on flatter ground. Current soil movement occurs in bare soil openings and rodent colonies	21 - 30
Soil movement advanced. Bare soil, surface rock fragments or pavement dominate but site still influenced by vegetation and litter. Large interspaces between perennials are dominated by annuals and occasionally younger perennial plants. Litter layer is lacking in most interspaces and confined to tree, shrub or grass understories. Pedestals common from partial loss of surface soil horizon or trampling displacement. Heaving and crusting of soil surface common. Current soil movement not being effectively arrested by vegetation or litter cover	11 - 20
Soil movement severe. Bare soil, surface rock fragments or pavement continuous and form the matrix within which colonies of perennials are growing. Interspaces between perennial plants are dominated by annuals. Litter layer usually absent or confined to immediate influence of perennial plants. Soil compaction may exceed 3 to 5 inch depth on flatter ground. Debris dams and excessive soil buildup against obstructions on steeper slopes. Plant pedestals and cupping out of perennials common. Overland movement of soil evident, deposition evident from air or water erosion	0 - 10

RECONNAISSANCE FORAGE AND SOIL RATING

The forage and soil rating of a needlegrass-dominated plant community can be aproximated by using either a 9.6 sq. ft. circular or a 1 sq. ft. square plot and estimating one of the following attributes:

a. The average crown cover aggregated for all herbaceous decreaser bunchgrasses.

b. The average number (or combined frequencies) of herbaceous decreaser bunchgrasses.

c. The average percentage of bare soil plus pavement.

At least ten circular or 20 to 30 square plots should be systematically placed after a random start is used. The average of the plots is compared to the criteria listed below. One square foot plot criteria are in parenthesis.

Rating Class	Herbaceous Decreaser Bunchgrasses						%BS + Pavemt	
	Cover		Density		Freq.			
Good	21+	(15+)	10+	(2.0+)	(70+)		<21%	(<15%)
Fair	11-20	(9-14)	7-9	(1.6-2.0)	(51-69)		21-35	(15-25)
Poor	6-10	(5-8)	4-6	(.8-1.5)	(36-50)		36-55	(26-44)
Very Poor	0-5	(0-4)	0-3	(0- .7)	(0-35)		56 +	(45+)

SPECIES LIST

Decreasers

Cele Cercocarpus ledifolius
Erum Eriogonum umbellatum
Putr Purshia tridentata
Rice Ribes cereum
Agsp Agropyron spicatum
Caro Carex rossii (rhizomatous)
Feid Festuca idahoensis
Sihy Sitanion hystrix
Stoc Stipa occidentalis
Baca Balsamorhiza careyana
Sein Senecio integerrimus

Increasers (palatable)

Lala Lathyrus lanszwertii
Lotr Lomatium triternatum

Increasers (unpalatable)

Arpa Arctostaphylos patula
Habl Haplopappus bloomeri
Acmi Achillea millefolium
Ange Antennaria geyeri
Arho Arabis holboellii
Chum Chimaphila umbellata
Erla Eriophyllum lanatum
Ernu Eriogonum nudum
Frvi Fragaria virginiana
Hisc Hieracium scouleri
Hofu Horkelia fusca
Luca Lupinus caudatus
Lule Lupinus lepidus
Mial2 Microseris alpestris
Peci Penstemon cinicola
Peeu Penstemon euglaucus
Pehu Penstemon humilis
Vipu Viola purpurea

Invaders

Ann Annual forbs

SUMMARY STATISTICS OF THREE-STEP SAMPLES 1/

	Mean	95% CI	CV	N
Decreaser + Palatable Increaser Hits 2/	.8	.23	.71	25
Decreaser Hits	-	-	-	
Palatable Increaser Hits	.8	.23	.71	25
Decreaser + Palatable Increaser Comp. 3/	87.8	4.24	.18	55
Decreaser Composition	37.3	5.07	.51	55
Palatable Increaser Composition	50.5	2.48	.36	55
Total Hits (all plants)	1.1	.30	.75	26
Species with 80% Presence:				
Purshia tridentata				
composition	35.8	5.27	.56	55
crown cover, line intercept	16.9	2.11	.47	55
crown cover, loop frequency hits	16.2	1.91	.44	55
Stipa occidentalis				
hits	.6	.18	.55	16
composition	42.6	4.44	.38	51
Sitanion hystrix				
hits	(inadequate sample)			
composition	3.4	.79	.73	38
Carex rossii				
hits	.7	.26	.54	8
composition	7.6	1.78	.83	48
Litter	87.3	2.79	.12	55
Moss	1.6	.28	.49	32
Bare soil + Pavement	11.2	2.58	.86	53
Rock	1.6	1.11	1.71	23

1/ Based on least-disturbed stands. 95% CI: 19 out of 20 samples lie between ± stated confidence interval assuming a normal distribution. CV: coefficient of variation = std. deviation/mean. N: sample size.

2/ Excludes shrub direct hits

3/ Includes shrubs in composition

SUMMARY STATISTICS, RECONNAISSANCE RATING GUIDE
(9.6 sq. ft. Circular Plot Data)

Attribute	Mean	95% CI	CV	N
Litter Cover	84.2	4.84	.19	44
Bare soil + Pavement Cover	14.9	4.27	1.01	48
Rock Cover	1.9	1.55	1.64	16
Stipa occidentalis				
density	2.7	.43	.54	45
foliar cover	2.3	.50	.68	39
Sitanion hystrix				
density	.4	.15	.68	16
foliar cover	.8	.39	.93	14
Carex rossii				
density	.5	.12	.68	28
foliar cover	.8	.27	.90	27

(1 sq. ft. Square Plot Data)

Attribute				
Litter cover	87.1	3.73	.12	30
Moss cover	1.1	.33	.78	24
Bare soil + pavement cover	10.6	2.90	.76	29
Rock cover	.6	.19	.86	26
Stipa occidentalis				
frequency	20.8	4.44	.57	28
foliar cover	1.3	.35	.76	29
Sitanion hystrix				
frequency	3.5	1.51	.75	12
foliar cover	.5	.32	.75	6
Carex rossii				
frequency	7.5	2.45	.69	17
foliar cover	.8	.39	.96	15

Forage Rating Guide
for
PINE/SHRUB/LONG-STOLON SEDGE

(Includes Ecoclass: CLS2-12, CPS2-14, CPS2-15, CPS3-12
CWC2-13, CWS1-15, CWS1-13)

VEGETATION DESCRIPTION

This forage rating guide applies to those forested plant communities which contain a shrub layer and have long-stolon sedge as the dominant herbaceous species. Associated shrub species can be bitterbrush, greenleaf manzanita, snowbrush, goldenweed, or squaw currant depending upon the specific community.

Long-stolon sedge is moderately palatable to cattle and highly palatable to sheep. The species increases appreciably following underburning, shallow soil scarification from logging disturbance, or light to moderate grazing use. The primary mode of reproduction is vegetative through rhizome elongation. Livestock utilization of the plant should be regulated to stimulate rhizome vigor rather than provide an adequate seed source. Rhizome vigor is encouraged by grazing in June and July to a 2-3 inch stubble height. Western needlegrass, squirreltail are usually found in association with long-stolon sedge. These species are decreasers which may become codominants with moderate grazing pressure or will increase considerably after logging disturbance. Long-stolon sedge is usually preferred by livestock over these other species. Range readiness is reached by late June for all but higher elevation lodgepole stands.

Ponderosa/ bitterbrush/ sedge in good forage rating. Bitterbrush well dispersed. Tree cover approximates 20%, basal area 160 sq. ft. Herbaceous production 15 lb/acre dry weight.

Ponderosa/ bitterbrush-manzanita/sedge in good forage rating. Sedge most common in shrub interspaces tree cover is 20%, basal area 125 sq. ft. Herbaceous production 30 lb/acre dry weight.

Bitterbrush becomes more palatable after mid July and is susceptible to browsing by livestock or deer. The shrub is easily killed by underburning during the summer or autumn months. Early spring burning with high soil or fine fuel moisture is less detrimental to the plant. These plant communities provide a difficult competitive environment for bitterbrush to quickly regain dominance once its density has been reduced by logging or burning. Long-stolon sedge is usually stimulated by the same disturbance that reduces bitterbrush so that shrub seedlings have difficulty becoming established in a site occupied by a rhizomatous sedge. Historically natural underburning occurred on the average of once every 30 years $\pm$ 4.7 (range: 9-59 years) within these communities. Experience has shown that both bitterbrush and trees have difficulty becoming established within the sedge competition 30 to 40 years following wildfire burn intensities.

Goldenweed strongly increases following logging or as a result of overgrazing, especially where soil parent material is basic scoria flow, pumice flow, or sandy outwash. Additional carrying capacity is lost from expansion of greenleaf manzanita and/or snowbrush after logging or burning. If the disturbance is severe enough to require reestablishment by seed germination, the long-stolon sedge competition slows rate of shrub expansion and reduces shrub stocking levels. Squaw currant is a palatable shrub which decreases under grazing pressure but aggressively increases with site disturbance. Squaw currant is most common in lodgepole communities.

Ponderosa/ bitterbrush/ sedge in poor forage rating. Scarification during logging removed bitterbrush and increased goldenweed. Natural tree regeneration dominated by lodgepole pine. Herbaceous 165 lbs/acre dry weight.

Bitterbrush has failed to regenerate in a vigorous stand of long-stolon sedge thirty years after its scarification via log skidding. Herbaceous production is 165 lb/acre dry weight.

SITE DESCRIPTION

The guide is restricted to the pumice deposition zone of Deschutes, Fremont, and Winema National Forests. Topography is gently undulating slopes of outwash plains, plateaus, terraces and toeslopes of escarpments and buttes. Slopes rarely exceed 15%. Soils are derived from pumice flow, basic scoria flow, outwash sand or airlaid pumice which has been subsequently reworked by gravity or water. A buried soil is usually greater than 30-40 inches below the soil surface. Soil profiles have an A1, AC, C horizonation with the C horizon usually of reworked pumice or volcanic sand. A perched water table is not present.

Basic scoria flow profile showing cobble content. 1 dm = 4 inches.

Dacite pumice flow profile showing no cobble content and an AC horizon to 24 inches. 1 dm = 4 inches.

Stands supporting greenleaf manzanita or snowbrush hold elevated positions in the local topography and escape the colder night temperatures during the growing season. Bitterbrush is restricted to lower elevations and is usually absent from xeric stands, high elevations, stands which contain volcanic sand or basic scoria flow. Goldenweed is usually restricted to sandy outwash, volcanic sand or basic scoria flow soils.

FORAGE RATING

Forage rating is based upon: 1) forage cover, 2) forage composition, and 3) plant vigor. These descriptions generally apply to stands in mid to late seral ecological status as defined in FSH 2209.21. Data are not available at this time for adequately rating early and very early ecological status. A qualitative description for each of four classes follows:

Good: Bitterbrush and/or squaw currant well distributed across stand, all age classes represented. Greenleaf manzanita, snowbrush if present, no greater than a codominant. Goldenweed occurs as scattered, very subordinate individuals or small groups; not successfully occupying large areas. Long-stolon sedge well distributed individuals. Denser sedge colonies without apparent mortality. Younger plants not restricted specifically to recently disturbed areas. Perennial and annual forbs are well distributed across interspaces between shrubs.

Distribution of long-stolon sedge in good forage rating. Herbaceous production is 110 lb/acre dry weight.

Fair: Bitterbrush and/or squaw currant represented by all age classes but somewhat aggregated in distribution due to tree closure or skidding disturbance. Greenleaf manzanita, snowbrush or goldenweed may be strong subordinates but are most aggressive as shown by age class distribution on disturbed sites. Long-stolon sedge well distributed individuals but denser sedge colonies more prevalent on disturbed sites or restricted to shrub understory. Some mortality with colonies is apparent. Western needlegrass and squirreltail common in interspaces but subordinate to long-stolon sedge in biomass, density or frequency represented. Perennial and annual forbs occur commonly as small colonies, most often restricted to shrub canopy.

Logged Ponderosa/bitterbrush/sedge in fair forage rating. Bitterbrush strongly clumped. Long-stolon sedge colonies with needlegrass as codominant. Tree basal area 15 sq. ft., herbaceous production 120 lb/acre dry weight.

Closeup of long-stolon sedge distribution in fair forage rating. Herbaceous production is 115 lb/acre dry weight.

Poor: Bitterbrush or squaw currant not evenly distributed but strongly clumped or as very widely scattered individuals; mainly represented by older age classes with little successful recruitment. Goldenweed readily occupies recently disturbed sites and usually occurs as colonies represented by all age classes. Greenleaf manzanita and/or snowbrush dominant over bitterbrush to point where most of browsing is concentrated on a few number of bitterbrush plants. Long-stolon sedge colonies show mortality. Pedestalling of older plants and smaller sedge colonies. Interspaces between shrubs occupied by western needlegrass, squirreltail and occasionally Ross sedge. These species can dominate over long-stolon sedge. Perennial forbs scarce and restricted to shrub canopies. Annual forbs prevalent irrespective of cyclic moisture-temperature patterns.

Very Poor: Stand so highly disturbed by overgrazing that bitterbrush, squaw currant or long-stolon sedge will not recover to satisfactory densities without artificial regeneration. Bitterbrush or squaw currant usually only as an occasional plant, young plants rare and die prematurely. Goldenweed may predominate the stand. Greenleaf manzanita or snowbrush can dominate the understory shrub layer, their canopy coverage may severely impact the production of herbaceous vegetation. Long-stolon sedge as scattered small colonies showing much mortality, individual clumps may be pedestalled. Successful recruitment into the interspaces by long-stolon sedge is not evident. Western needlegrass and squirreltail dominate over long-stolon sedge. Distribution of grasses is sparce and clumped. Perennial forbs restricted to shrub canopies. Annuals as Crypthania, chickweed, Collinsia, annual Eriogonum are common.

Logged Ponderosa/bitterbrush/sedge in very poor forage rating. Area used as sheep bedground subsequent to logging. Tree basal area is 90 sq. ft., herbaceous production 40 lb/acre dry weight.

Closeup of long-stolon sedge distribution in very poor forage rating. Herbaceous production is 30 lb/acre dry weight.

FORAGE COVER RATING

The use of the three-step method in these communities rarely result in greater than 6 direct hits on herbaceous plants per 100 ft. of transect in good forage rating. For this reason direct hits on decreaser shrub canopies are added to hits on decreaser and palatable increaser herbaceous species for purposes of calculating a forage cover rating.

Plant hits are affected by tree canopy closure. Decreaser and palatable increaser hits (including shrub overstory) decrease 9.4 hits for every 10% increase in tree crown cover. Adjustment for crown closure requires a line intercept estimate of tree crown along the same transect used to measure loop frequency for plant hits. Measure crown intercept of the tree overstory plus tree understory along the line using at least 200 ft. of transect. The understory cover is added to the overstory estimate for a total tree crown. The forage cover class is then adjusted downward according to the following table given the total tree crown intercept.

Tree crown intercept	Forage cover class
0 - 35%	35
36 - 45%	20
46%+	12

In situations when plant hits are greater than indicated by the forage cover class and tree intercept catagory, use the next highest index class to rate forage cover. For example, a stand may have 40% tree cover and 27 hits on D&PI plants including shrubs. The tree cover indicates forage cover class 20 should be used but the maximum number of hits permitted within that class is only 24. Therefore the 27 hits is evaluated with respect to forage cover class 25 rather than 20.

A maximum of 25 points is assigned to forage cover. The following table lists the number of points given by forage cover according to the number of decreaser and palatable increaser plant hits averaged for a cluster of 2 or more transects.

Number of hits	Point Rating by Cover Class					
	35	30	25	20	15	12
35-39+	25					
30-34	22	25				
25-29	19	22	25			
20-24	16	18	21	25		
15-19	13	15	17	21	25	
12-14	11	12	14	17	21	25
9-11	9	10	11	13	16	20
6-8	7	8	9	10	12	15
3-5	5	5	6	7	8	10
0-2	2	3	3	3	4	5

Distribution of shrub and herbaceous layer in lodgepole/ bitterbrush/ sedge when tree cover averages 40%, basal area 85 sq. ft. Herbaceous production is 20 lb/acre dry weight.

Tree crown closure of 60% reduces ground vegetation considerably. Tree basal area 100 sq. ft./acre and herbaceous production is 15 lb/acre dry weight.

ORAGE
OMPOSITION
ATING

Forage composition within these communities is essentially unaffected by either tree cover less than 60% or stand basal area less than 200 square feet. Shrubs classified as decreasers are included in the forage composition rating. Consequently, closest perennial sampling along the three-step transects should include shrubs in composition.

A maximum of 65 points is assigned to forage composition. Assign one point for each percent composition of herbaceous and shrubby decreasers. Limits are set on the composition of palatable increaser grasses. Do not count more than 20% composition of western needlegrass, 10% composition each of bottlebrush squirreltail and Ross sedge. Assign one point for each percent composition of palatable increasers within these limits. A sum of the points for decreasers and palatable increasers is used to rate forage composition by finding the points in the left column and reading appropriate rating on the right column:

Calculated Composition Points	Composition Rating
81-100	53-65
66-80	40-52
51-65	27-39
36-50	14-26
0-35	0-13

Maximum Limits:

20% needlegrass
10% squirreltail
10% Ross sedge

PLANT VIGOR RATING

Plant vigor responds to annual weather patterns, grazing pressure, site disturbance and tree crown closure. The following guide is used to rate the vigor that results from livestock grazing on a 10 point scale:

Description	Rating
Average maximum leaf length of sedge plants and bunchgrasses exceeds 75% of seasonal potential. Over 30% of plants are young tillers. Current twigs of mature bitterbrush are vigorous, seedlings and immature plants common. This vigor exists only on deteriorated range in maximum upward trend	9 - 10
Mortality occasionally evident within colonies of mature sedge plants. Average maximum leaf length of sedge plants and bunchgrasses between 51 and 75% of seasonal potential. Less than a quarter of plants are young tillers. Current twigs of bitterbrush vigorous; seedlings or immature well represented. This vigor exists on deteriorated range in moderate up trend or range approaching good forage rating	6 - 7 - 8
Mortality of sedge plants evident within many clumps. Root crowns displaced with some effort, occasional pedestalling. Average maximum leaf or seed stalk length between 26 and 50% of seasonal potential. Young tillers less than 10 to 15% of plants present. Bitterbrush showing some decadent branches and individuals, stand recruitment about averages mortality. This vigor experienced in any rating class having from moderate down trend to no apparent trend	3 - 4 - 5
Internal portions of sedge plants and bunchgrass clumps show much mortality. Root crowns usually pedestalled or weak and easily displaced. Seed stalks of bunchgrasses produced only under favorable climatic conditions. Average maximum leaf or seed stalk length less than 25% of seasonal potential. Young tillers not evident or very occasional. Bitterbrush showing much decadence in crown as well as individuals, very few seedlings evident. This vigor exists on deteriorated range with maximum down trend	0 - 2

FORAGE PRODUCTION

Forage production (excluding shrubs) averages 56 lbs/A air dry weight ± 14 lbs at 95% confidence interval under good forage rating.

Production in these communities is not strongly influenced by tree overstory, stand basal area or easily measured soil attributes. Native herbaceous production can be increased 2 to 3 times by lightly disturbing the soil surface as that which occurs during logging scarification. Light to moderate underburning substantially reduces shrub production but increases herbaceous production up to five times pre-burning levels. Moderate grazing can increase production of long-stolon sedge 1.5 to 2 times by stimulating tiller development and increasing sedge density.

These communities can be considered forested rangeland since long-stolon sedge is resilient to tree canopy closure and site scarification. Bitterbrush may provide a large portion of the forage until logging or burning activities reduce its stocking level. Reestablishment of this browse species is delayed by competition from long-stolon sedge and goldenweed.

SOIL STABILITY RATING

Soil stability is evaluated using two criteria, the amount of ground surface exposed and evidence of current soil erosion. Both criteria receive an equal weight of 50.

Bare Soil Index

The bare soil index is based on the number of transect hits on bare soil plus pavement, that is, all surface fragments less than 3/4 inch in diameter. Particle size distribution in pumice parent material makes it very difficult to separate bare soil coarse fragments from pavement sized fragments which result from accelerated erosion. This is especially true for pumice flow and basic scoria flow soils typified by these communities. Transect hits are averaged for a cluster. Bare soil attributed to logging is added to naturally-occuring bare soil hits. Bare soil rating is then scored by the following table which is adjusted for central Oregon situations:

Bare Soil + Pavement Hits	Index
Less than 6	45-50
15-6	35-44
25-16	25-34
35-26	15-34
Greater than 35	0-14

Some bare soil is normal for these communities; under stable conditions bare soil rarely exceeds 10%.

Current Soil Erosion Index

The following criteria incorporated natural as well as erosion induced by logging and grazing activities:

Description	Rating
No evidence of soil movement. Bare spaces small and well dispersed. Interspaces between shrubs occupied by young perennial forbs, sedges, grasses, or litter. Rhizomatous sedges as large continuous colonies. Pedestalling of perennials and rock fragments is from frost heaving and not accelerated soil movement. Soil surface spongy to walk, not compacted. Trampling displacement not evident. No active rills or gullies on slopes. Soil deposition from animal burrows or colluvial action and not water or air movement	41 - 50
Soil movement slight and local. Erosion confined to individual bare spaces. Larger interspaces are colonized by perennials. Moss cover stabilized under shrubs. Plant pedestalling from frost heaving, not excessive soil erosion or trampling. Some litter and soil may accumulate on upslope side of logs and shrubs due to colluvial movement and soil creep. Soil surface usually porous and friable, being compacted only in interspaces or localized areas. Little evidence of trampling displacement. Sheet erosion light and only from severe storms	31 - 40
Soil movement moderate. Bare spaces or erosion pavement continuous and interconnected. Interspaces between shrubs partially occupied by young perennials or patches of litter. Rhizomatous sedges as scattered clumps. Plant pedestals due to soil movement, frost heaving or grazing. Soil and plant displacement from grazing animals. Cupping out below shrubs on steeper slopes. Compaction with interspaces evident on flatter ground. Some soil mounds may occur under shrubs. Current soil movement occurs in bare soil, soil openings and rodent colonies	21 - 30

Description	Rating
Soil movement advanced. Bare soil, surface rock fragments or pavement dominate but site still influenced by vegetation and litter. Large interspaces between perennials are dominated by annuals and occasionally younger perennial plants. Litter layer is lacking in most interspaces and confined to tree, shrub or grass understories. Pedestals common from partial loss of A1 surface soil horizon or trampling displacement. Heaving and crusting of soil surface common. Current soil movement not being effectively arrested by vegetation or litter cover	11 - 20
Soil movement severe. Bare soil, surface rock fragments or pavement continuous and form the matrix within which colonies of perennials are growing. Interspaces between perennial plants lack vegetation or dominated by annuals. Rhizomatous species occur as very localized, depauperate colonies. Litter layer usually absent or confined to immediate influence of perennial plants. Most of area uninfluenced by vegetation or litter. Soil compaction may exceed 3-5 inch depth on flatter ground. Debris dams and excessive soil buildup against obstructions on steeper slopes. Plant pedestals and cupping out of perennials common. Overland movement of soil evident, deposition evident from air or water erosion	0 - 10

RECONNAISSANCE FORAGE AND SOIL RATING

The forage and soil rating of a long-stolon sedge dominated plant community can be approximated by using either a 9.6 sq. ft. circular or a 1 sq. ft. square plot and estimating one of the following attributes:

a. The average crown cover aggregated for all herbaceous decreaser plants.

b. The average aggregated density or frequency of herbaceous decreaser plants.

c. The average percentage of bare soil plus pavement.

At least ten circular or 20 to 30 square plots should be systematically placed after a random start is used. The average of the plots is compared to the criteria listed below. One square foot plot criteria are in parenthesis.

Rating Class	Herbaceous Decreasers				% Bare soil + Pavement	
	% Cover		Density	Freq.		
Good	21+	(15+)	11+	(66+)	0-10	(0-5)
Fair	11-20	(9-14)	8-10	(46-65)	11-20	(6-15)
Poor	6-10	(5-8)	5-7	(31-45)	21-34	(16-30)
Very Poor	0-5	(0-4)	0-4	(0-30)	35+	(30+)

SPECIES LIST

Decreasers

Erum Eriogonum umbellatum
Putr Purshia tridentata
Rice Ribes cereum
Cape Carex pensylvanica (R)
Sihy Sitanion hystrix
Stoc Stipa occidentalis

Increasers (palatable)

Caro Carex rossii
Kega Kelloggia galioides (R)

Increasers (unpalatable)

Arpa Arctostaphylos patula
Ceve Ceanothus velutinus
Habl Haplopappus bloomeri
Acmi Achillea millefolium
Ange Antennaria geyeri
Casc Campanula scabrella
Chum Chimaphila umbellata
Epan Epilobium angustifolium
Erla Eriophyllum lanatum
Frvi Fragaria virginiana
Hial Hieracium albiflorum
Lual Lupinus albicaulis
Luan Lupinus andersoni
Mial2 Microseris alpestris
Minu Microseris nutans
Peci Penstemon cinicola
Peeu Penstemon euglaucus
Phha Phacelia hastata
Vipu Viola purpurea

Invaders

Ann Annual forbs

R = rhizomatous growth form

SUMMARY STATISTICS OF THREE-STEP SAMPLES [1]

	Mean	95% CI	CV	N
Decreaser + Palatable Increaser Hits [2]	2.7	1.70	1.33	17
Decreaser Hits	2.6	1.82	1.39	16
Palatable Increaser Hits	(Insufficient sample size)			
Decreaser + Palatable Increaser Comp. [3]	94.5	5.54	.13	20
Decreaser Composition	90.5	6.26	.16	20
Palatable Increaser Composition	7.6	6.02	1.38	12
Total Hits (all plants)	2.7	1.70	1.33	17
Species with 80% Presence:				
Purshia tridentata				
crown cover, loop frequency hits	24.2	6.89	.65	20
composition	14.3	5.10	.79	19
Carex pensylvania				
hits	2.7	2.06	1.41	13
composition	49.8	12.76	.57	19
Carex rossii				
hits	.6	.19	.37	5
composition	10.2	7.40	1.11	9
Stipa occidentalis				
hits	.8	.17	.39	9
composition	26.8	8.83	.73	19
Sitanion hystrix				
hits	(Insufficient sample size)			
Composition	6.0	2.70	.73	10
Litter	88.7	2.90	.07	20
Moss	1.2	.42	.60	11
Bare soil + Pavement	6.3	2.22	.78	19
Rock	2.7	.96	.70	15

1/ Based on least disturbed stands. 95% CI: 19 out of 20 samples lie between ± stated confidence interval assuming a normal distribution. CV: coeff. of variation = std. deviation/mean. N: sample size.

2/ Excludes shrub direct hits.

3/ Includes shrubs in composition.

SUMMARY STATISTICS, RECONNAISSANCE RATING GUIDE
(9.6 sq. ft. Circular Plot Data)

Attribute	Mean	95% CI	CV	N
Litter cover	87.3	4.92	.13	21
Bare soil + Pavement cover	9.3	1.05	.99	20
Rock cover	5.4	3.62	1.32	15
Carex pensylvania				
density	3.9	1.31	.66	15
foliar cover	11.8	3.83	.70	18
Stipa occidentalis				
density	3.6	1.19	.76	20
foliar cover	5.1	1.67	.75	20
Sitanion hystrix				
density	.8	.56	.77	4
foliar cover	1.5	.53	.41	5
(1 sq. ft. Square Plot Data)				
Litter cover	96.4	1.78	.02	5
Bare soil + Pavement cover	2.2	.99	.52	5
Rock cover	1.5	1.08	.84	5
Carex pensylvania				
foliar cover	12.6	8.6	.69	4
frequency	54.5	40.09	.83	5
Stipa occidentalis				
foliar cover	2.0	1.13	.63	5
frequency	22.0	10.32	.53	5

PREDICTION EQUATION

1. Decreaser + Palatable Increaser Plant Hits (including shrub overstory) = 59.26 - .9457 (% tree overstory intercept)

   F = 17.37 @ 1 and 17 degrees of freedom
   R^2 = .505
   Sy.x = 11.18 hits
   Equation limits: 10-60% cover. No stands sampled in excess of 60% cover.

F = F statistic for testing significance of the equation.

R^2 = Coefficient of determination, measures the amount of variation contained in test data that is accounted for by the equation.

Sy.x = Standard error of estimate of sample mean for dependent variable, gives one standard deviation around mean of dependent variable. One standard deviation includes about 2/3rds of the population variation.

Forage Rating Guide
for
PINE/LONG-STOLON SEDGE

(Includes Ecoclass: CLG4-11, CLG4-12, CPG2-12)

VEGETATION DESCRIPTION

This guide applies to those ponderosa and lodgepole plant communities which have a poorly represented shrub layer and long-stolon sedge as the dominant herbaceous species. The two most common shrubs are squaw currant and goldenweed. Bitterbrush, greenleaf manzanita, snowbrush or golden chinkapin may be present but usually with less than 3-5% foliar cover.

Ponderosa/sedge-fescue-peavine in good forage rating. Soils are volcanic sand. Tree crown cover is 62%, basal area is 230 sq. ft. Herbaceous production is 145 lb/acre dry weight.

Lodgepole/sedge-lupine in good forage rating. Stand burned 65 years previous. Herbaceous production is 50 lb/acre dry weight.

Long-stolon sedge is moderately palatable to cattle and highly palatable to sheep. The species increases following underburning, shallow soil scarification from logging, or light to moderate grazing use. The primary mode of reproduction is vegetative through rhizome elongation. Livestock utilization of the plant should be regulated to stimulate rhizome vigor rather than provide an adequate seed source. Rhizome vigor is encouraged by grazing in June and July to a 2-3 inch stubble height. Pocket gophers are common within these communities and tend to stimulate rhizome development by their grazing behavior and soil borrowing activity.

Western needlegrass, squirreltail and occasionally Ross sedge are usually found in association with long-stolon sedge. These species are decreasers which may become codominants with moderate grazing pressure or will increase considerably after logging disturbance. Those ponderosa pine stands found in northern end of pumice zone also support pinegrass, blue wildrye, melica, California and Columbia bromegrass, all of which are about equally palatable as livestock forage. Idaho fescue can be a codominant and will decrease under grazing. The lupines associated with long-stolon sedge are of low palatability but are not poisonous to livestock.

Goldenweed strongly increases following logging or as a result of overgrazing. If disturbance is severe enough to require reestablishment via seed germination, the long-stolon sedge competition slows rate of shrub expansion and reduces shrub stocking levels. Squaw currant is a palatable shrub which decreases under grazing pressure but aggressively increases with site disturbance. Squaw currant is most common in lodgepole pine stands.

Lodgepine/sedge-lupine ten years following clear-cutting and slash treatment with Marden brush cutter. Note failure of natural tree regeneration to establish. Herbaceous production is 380 lb/acre dry weight.

Underburning stimulates the rhizomatous species and lupines but considerably reduces shrub stocking levels. Both shrubs and tree seedlings have difficulty becoming established in a site occupied by rhizomatous species. Evidence of past natural underburns is scarce within these communities. Limited data suggest recorded fire perodicity ranged from 15 to 40 years. Apparently underburns in stands with primarily herbaceous understories were not intense enough to kill tree cambium.

SITE DESCRIPTION

The guide is restricted to the immediate east slope of the Cascades which lies on Deschutes and Winema National Forests. Topography is undulating to rolling slopes of benches, plateaus, terraces and toeslopes to midslope positions of escarpments and buttes. Slopes rarely exceed 45%. Soils are derived from basic scoria flow, outwash sand, or volcanic sand which have been subsequently reworked by gravity or water. A buried soil is usually found at depths greater than 40 inches below the soil surface. Soil profiles have an A1, AC, C horizonation. A perched water table is not present.

Basic scoria flow soil profile.
1 dm = 4 inches

Stands which contain occasional greenleaf manzanita, golden chinkapin or snowbrush hold elevated positions in the local topography and escape the colder night temperatures during the growing season. Bitterbrush is very subordinate, being restricted to lower elevations and is usually absent from xeric high elevations stands which contain volcanic sand or basic scoria flow. Goldenweed is usually restricted to sandy outwash, volcanic sand or basic scoria flow soils.

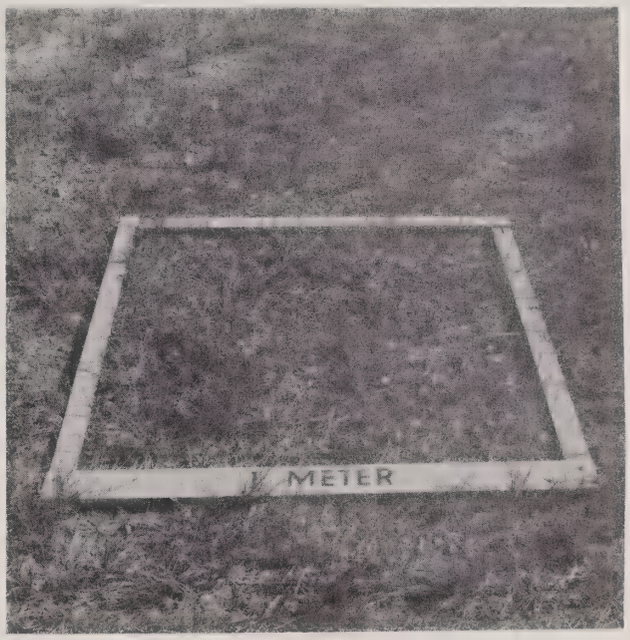
FORAGE RATING

Forage rating is based upon: 1) forage cover, 2) forage composition, and 3) plant vigor. These descriptions generally apply to stands in mid to late seral ecological status as defined for in FSH 2209.21. Data is not available at this time for adequately rating early and very early ecological status. A qualitative description for each of four classes follows.

Good: Goldenweed occurs as scattered, very subordinate individuals or small groups; not successfully occupying large areas. Long-stolon sedge well distributed individuals. Denser sedge colonies without apparent mortality. Younger plants not restricted specifically to recently disturbed areas. Perennial bunchgrasses well distributed, not pedestalled or with decayed centers. Perennial forbs are well distributed across interspaces between trees and bunchgrass or sedge colonies. Forbs abundant only in moist years.

Ponderosa/sedge-fescue-peavine in good forage rating. Tree cover is 20%, basal area is 160 sq. ft. Herbaceous production is 40 lb/acre dry weight.

Fair: Goldenweed may be strong subordinate and very aggressive as shown by age class distribution on disturbed sites. Rhizomatous sedges and grasses usually as well distributed individuals. Denser colonies more prevalent on disturbed sites or restricted to tree understory. Some mortality within colonies is apparent. Western needlegrass and squirreltail common in interspaces but subordinate to long-stolon sedge in biomass, density or frequency represented. Idaho fescue, when present, represented by a perponderance of older, pedestalled plants. Perennial forbs occur commonly as small colonies, most often restricted to protected microsites. Annual forbs restricted to more open interspaces and areas of soil disturbance.



Closeup showing distribution of long-stolon sedge in fair forage rating. Herbaceous production is 50 lb/acre dry weight.

Closeup of lupine dominated ground vegetation mixed with long-stolon sedge. Fair forage rating. Herbaceous production is 100 lb/acre dry weight.

Poor: Goldenweed very aggressive on recently disturbed sites and usually occurs as colonies represented by all age classes. Rhizomatous sedge and grass colonies show mortality. Population generally lacks younger individuals. Pedestalling of older plants and smaller sedge colonies. Bunchgrasses as Idaho fescue and bromegrass show lack of recruitment and have perponderance of older, pedestalled, partially decadent plants. Perennial forbs scarce and restricted to tree canopies. Annual forbs prevalent irrespective of cyclic moisture-temperature patterns.

Very Poor: Stand so highly disturbed by overgrazing that squaw currant, perennial bunchgrasses or sedges will not recover to satisfactory densities without artificial regeneration. Goldenweed may dominate the stand. Pinegrass, blue wildrye or long-stolon sedge as scattered small colonies. Individual clumps may be pedestalled. Successful recruitment into the interspaces by rhizomatous species is not evident. Idaho fescue usually pedestalled with perponderance of older, partially decadent plants. Distribution of grasses is sparce and usually clumped under dense tree canopies. Perennial forbs restricted to protected sites. Annuals as Crypthania, chickweed, Collinsia are common.

FORAGE COVER RATING

The use of the three-step method in these communities rarely results in greater than 10 direct hits on herbaceous plants per 100 feet of transect in good forage rating, an average being 5.5 hits.

A maximum of 25 points is assigned to forage cover. The following table lists the number of points for rating cover according to the number of herbaceous decreaser and palatable increaser plant hits averaged for a cluster of 2 or more transects.

Number of hits	Point rating
9+	20-25
6-8	13-19
3-5	7-12
0-2	0-6

FORAGE COMPOSITION RATING

Forage composition of these two communities is essentially unaffected by either tree cover less than 60% or stand basal area less than 200 sq. ft. Increase the calculated composition rating by 10 points for tree canopies and basal area canopies exceeding these limits. Although a minor component in the stand, decreaser shrubs are included in the forage composition rating. Therefore, closest perennial sampling along three-step transects should include all shrubs in composition.

A maximum of 65 points is assigned to forage composition comprised of herbaceous and shrub decreasers and palatable herbaceous increasers. The resulting composition value is used to rate forage composition by entering the following table:

Calculated Composition Value	Composition Rating
80-100	53-65
60-79	40-52
40-59	27-39
20-39	14-26
0-19	0-13

PLANT VIGOR RATING

Plant vigor responds to annual weather patterns, grazing pressure, site disturbance and tree crown closure. The following guide is used to rate the vigor that results from livestock grazing on a 10 point scale:

Description	Rating
Average maximum leaf length of sedge plants and bunchgrasses exceed 75% of seasonal potential. Over 30% of plants are young tillers, seedlings or immature individuals, decadence rare. Current twigs of mature squaw currant are vigorous, seedlings and immature plants common. This vigor exists only on deteriorated range in maximum upward	9 - 10
Mortality of sedge plants and bunchgrasses occasionally evident within colonies. Average maximum leaf length between 51 and 75% of seasonal potential. Less than a quarter of plants are young tillers, seedlings or immature. Current twigs of squaw currant vigorous; seedlings or immature well represented, but not common. This vigor exists on deteriorated range in moderate up trend or range approaching good	6 - 7 - 8
Mortality of sedge plants and bunchgrasses evident within many clumps. Root crowns displaced with some effort, occasional pedestalling. Average maximum leaf or seed stalk length between 26 and 50% of seasonal potential. Young tillers, seedling or immature individuals less than 10 to 15% of plants present. Squaw currant showing some decadent branches and individuals, stand recruitment about averages mortality. This vigor experienced in any rating class having from moderate down trend to no apparent trend	3 - 4 - 5

	Description	Rating
	Internal portions of sedge plant and bunchgrass clumps show much mortality. Root crowns usually pedestalled or weak and easily displaced. Seed stalks of bunchgrasses produced only under favorable climatic conditions. Average maximum leaf or seed stalk length less than 25% of seasonal potential. Young tillers, seedling or immature individuals not evident or very occasional. Squaw currant showing much decadence in crown as well as individuals, very few seedlings evident. This vigor exists on deteriorated range with maximum down trend	0 - 2

FORAGE PRODUCITON

Forage production (excluding shrubs) averages 220 lbs/acre air dry weight $\pm$ 100 lbs at 95% confidence interval under good forage rating.

Production in these communities is not strongly influenced by tree overstory, stand basal area or easily measured soil attributes. There is a tendency for forage production to be greater on concave to undulating microrelief and slopes greater than 5% gradient. Native herbaceous production can be increased 2 to 3 times by lightly disturbing the soil surface as that which occurs during logging scarification. Light to moderate underburning increases herbaceous production 3 to 4 times over a 10-15 year period. Moderate grazing can increase production of long-stolon sedge 1.5 to 2 times by stimulating tiller development and increasing sedge density.

These communities can be considered forested rangeland since long-stolon sedge is so resilient to tree canopy closure and site scarification. Reestablishment of any browse species as squaw currant is delayed by competition from long-stolon sedge and goldenweed.

SOIL STABILITY RATING

Soil stability is evaluated using two criteria, the amount of ground surface exposed and evidence of current soil erosion. Both criteria receive an equal weight of 50.

Bare Soil Index

The bare soil index is based on the number of transect hits on bare soil plus pavement, that is, all surface fragments less than 3/4 inch in diameter. Particle size distribution in pumice parent material makes it very difficult to separate bare soil coarse fragments from pavement-sized fragments which result from accelerated erosion. This is especially true for volcanic sand and basic scoria flow soils typified by these communities. Transect hits are averaged for a cluster. Bare soil attributed to logging is added to naturally occurring bare soil hits. Bare soil rating is then scored by the following table which is adjusted for central Oregon situations.

Bare Soil + Pavement Hits	Index
Less than 9	45-50
20-9	35-44
30-21	25-34
40-31	15-24
Greater than 40	0-14

Some bare soil is normal for these communities; under stable conditions bare soil rarely exceeds 10%.

Current Soil Erosion Index

The following criteria incorporates natural as well as erosion induced by logging and grazing activities.

Description	Rating
No evidence of soil movement. Bare spaces small and well dispersed. Interspaces between trees occupied by young perennial forbs, sedges, grasses, or litter. Pedestalling of perennials and rock fragments is from frost heaving and not accelerated soil movement. Soil surface spongy to walk, not compacted. Trampling displacement not evident. No active rills or gullies on slopes. Soil deposition from animal burrows or colluvial action and not water or air movement	41 - 50
Soil movement slight and local. Erosion confined to individual bare spaces. Larger interspaces are colonized by perennials. Moss cover stabilized under shrubs. Plant pedestalling from frost heaving, not excessive soil erosion or trampling. Some litter and soil may accumulate on upslope side of logs and shrubs due to colluvial movement and soil creep. Soil surface usually porous and friable, being compacted only in interspaces or localized areas. Little evidence of trampling displacement. Sheet erosion light and only from severe storms	31 - 40

Description	Rating
Soil movement moderate. Bare spaces or erosion pavement continuous and interconnected. Interspaces between trees partially occupied by young perennials or patches of litter. Plant pedestals due to soil movement frost heaving or grazing. Soil and plant displacement from grazing animals. Cupping out below bunchgrasses on steeper slopes. Compaction within interspaces evident on flatter ground. Some soil mounds may occur under shrubs. Current soil movement occurs in bare soil, soil openings and rodent colonies	21 - 30
Soil movement advanced. Bare soil, surface rock fragments or pavement dominate but site still influenced by vegetation and litter. Large interspaces between perennials are occupied by annuals and occasionally younger perennial plants. Litter layer is lacking in most interspaces and confined to tree, shrub or grass understories. Pedestals common from partial loss of A1 surface soil horizon or trampling displacement. Heaving and crusting of soil surface common. Current soil movement not being effectively arrested by vegetation or litter cover	11 - 20
Soil movement severe. Bare soil, surface rock fragments or pavement continuous and form the matrix within which colonies of perennials are growing. Interspaces between perennial plants lack vegetation or dominated by annuals. Litter layer usually absent or confined to immediate influence of perennial plants. Most of area uninfluenced by vegetation or litter. Soil compaction may exceed 3 to 5 inch depth on flatter ground. Debris dams and excessive soil buildup against obstructions on steeper slopes. Plant pedestals and cupping out of perennials common. Overland movement of soil evident, deposition evident from air or water erosion ...	0 - 10

RECONNAISSANCE FORAGE AND SOIL RATING

The forage and soil rating of a long-stolon sedge dominated plant community can be approximated by using either a 9.6 sq. ft. circular or a 1 sq. ft. square plot and estimating one of the following attributes:

a. The average crown cover aggregated for all herbaceous decreaser plants.

b. The average aggregated density or frequency of herbaceous decreaser plants.

c. The average percentage of bare soil plus pavement.

At least ten circular or 20 to 30 square plots should be systematically placed after a random start is used. The average of the plots is compared to the criteria listed below. One square foot plot criteria are in parenthesis.

Rating Class	Herbaceous Decreaser %Cover	Density	Freq.	% Bare soil + Pavement
Good	21+ (15+)	11+	(66+)	0-10 (0-5)
Fair	11-20 (9-14)	8-10	(46-65)	11-20 (6-15)
Poor	6-10 (5-8)	5-7	(31-45)	21-34 (16-30)
Very Poor	0-5 (0-4)	0-4	(0-30)	35 + (30 +)

SPECIES LIST

Decreasers

Erum	Eriogonum umbellatum
Rice	Ribes cereum
Brca	Bromus carinatus
Brvu	Bromus vulgaris (R)
Cape	Carex pensylvanica (R)
Feid	Festuca idahoensis
Mear	Melica aristata
Sihy	Sitanion hystrix
Stoc	Stipa occidentalis

Increasers, Palatable

Caro	Carex rossii
Caru	Calamagrostis rubescens (R)
Elgl	Elymus glaucus (R)
Kega	Kelloggia galioides (R)
Lala2	Lathyrus lanszwertii (R)
Lane	Lathyrus nevadensis
Syal	Symphoricarpus albus (Game only)

Invaders

Ann	Annual forbs
Ptaq	Pteridium aquilinum pubescens

Increasers, Unpalatable

Arpa	Arctostaphylos patula
Cach	Castanopsis chrysophylla
Ceve	Ceanothus velutinus
Habl	Haplopappus bloomeri
Asra	Aster radulinus
Acmi	Achillea millefolium
Ange	Antennaria geyeri
Cice	Cirsium centaureae
Chum	Chimaphila umbellata
Epan	Epilobium angustifolium
Erla	Eriophyllum lanatum
Frvi	Fragaria virginiana
Gabo	Galium boreale
Hial	Hieracium albiflorum
Hisc	Hieracium scouleri
Lual	Lupinus albicaulis
Luan	Lupinus andersoni
Lula	Lupinus latifolius
Mial2	Microseris alpestris
Minu	Microseris nutans
Peci	Penstemon cinicola
Peeu	Penstemon euglaucus
Phhe	Phacelia heterophylla
Smst	Smilacina stellata
Vipu	Viola purpurea

SUMMARY STATISTICS OF THREE-STEP SAMPLES 1/

	Mean	95% CI	CV	N
Decreaser + Palatable Increaser Hits 2/	5.1	3.11	.82	7
Decreaser Hits	4.7	2.96	.85	7
Palatable Increaser Hits	.8	.56	.69	4
Decreaser + Palatable Increaser Comp. 3/	83.5	6.76	.10	8
Decreaser Composition	76.8	11.18	.19	8
Palatable Increaser Composition	13.5	8.97	.68	4
Total Hits (all plants)	5.5	3.43	.84	7
Species with 80% Presence:				
Carex pensylvanica				
hits	1.8	.79	.56	6
composition	44.9	13.86	.44	8
Stipa occidentalis				
hits	.8	.82	.69	3
composition	13.7	8.39	.82	7
Sitanion hystrix				
hits	.7	.33	.43	3
composition	8.8	4.48	.64	6
Festuca idahoensis				
hits	3.5	1.65	.48	4
composition	15.6	4.03	.26	4
Litter	87.2	6.45	.11	8
Moss	(insufficient data)			
Bare soil + pavement	6.9	4.11	.86	8
Rock	1.4	1.16	.85	4

1/ Based on least disturbed stands with less than 60% tree crown cover. 95% CI: 19 out of 20 samples lie between ± stated confidence interval assuming a normal distribution. CV: coeff. of variation = std. deviation/mean. N = sample size.

2/ Excludes shrub direct hits.

3/ Includes shrubs in composition.

SUMMARY STATISTICS, RECONNAISSANCE RATING GUIDE 1/
(9.6 sq. ft. Circular Plot Data)

Attribute	Mean	95% CI	CV	N
Litter cover	93.9	2.69	.05	12
Bare soil + Pavement cover	5.5	2.82	.86	11
Rock cover	.8	.57	1.18	11
Carex pensylvanica				
foliar cover	6.9	2.45	.60	11
Stipa occidentalis				
density	2.4	1.72	1.22	11
foliar cover	3.1	1.91	1.04	11
Sitanion hystrix				
density	.5	.21	.56	6
foliar cover	1.1	.54	.67	7

1/ Data is not available for reconnaissance sampling with a 1 sq. ft. square plot frame. One square foot data criteria from the Pine/Shrub/Long-Stolon Sedge forage rating guide are applied to these communities.

Forage Rating Guide
for
MIXED CONIFER/PINEGRASS

(Includes Ecoclass: CWC2-12, CDS6-14)

VEGETATION DESCRIPTION

This forage rating guide applies to those ponderosa pine, Douglas-fir, and white fir plant communities which have pinegrass as the dominant herbaceous species. Associated shrub species can be common snowberry, baldhip rose, greenleaf manzanita, snowbrush, golden chinkapin, serviceberry or oceanspray depending upon the specific community and seral stage.

Stands underburned within the last 30 years usually contain a weak representation of a shrub layer. Pinegrass has a rhizamatous growth form and is very resistant to fire, especially underburns. Reseeding of increaser shrubs as snowbrush, manzanita or chinkapin is suppressed by the competitive ability of rhizomatous pinegrass. Soil displacement as scarification from logging may significantly reduce pinegrass density and permit excessive establishment of manzanita, snowbrush, and chinkapin along skidtrails and in log landings. In addition to site scarification, manzanita and snowbrush usually hold to elevated positions in the local topography which are relati-vely free of cold air ponding.

Mid-seral stand of Mixed conifer/ snowbrush-chinkapin/ pinegrass. Dominated by ponderosa pine having 30 percent crown cover, 120 sq. ft. basal area. Snowbrush with 35 percent cover. Herbage production is 120 lbs. per acre dry wt. Good forage rating. Fire 70 yrs. ago.

Mid-seral stand dominated by ponderosa pine with scattered white fir. Overstory cover 20 percent with 50 percent cover of tree regeneration. Stand logged 10 yrs. previous. Dense pinegrass suppresses expansion of snowbrush. Good forage rating.

Pinegrass is moderately palatable to cattle in June and becomes less palatable by mid to late summer. It's feed value remains comparable to orchardgrass prior to mid-August. The species is not preferred sheep or big game forage except for the inital two or three years following underburning when a mild fertilizer response is in effect. Pinegrass is a cool season grass initiating growth in mid-spring, going into mid-summer dormancy, and in absence of grazing and with favorable moisture, will regrow in early autumn. The plant is sensitive to grazing at stublle heights approximately 4 to 6 inches. Season-long grazing to these heights can reduce forage yields by decreasing tiller density per unit area. The plant is most sensitive to use in mid-July and through mid-August as it enters mid-summer dormancy.

Pinegrass vigor can be maintained by short season grazing in late spring and again during mid-summer dormancy. Season-long use is not recommended. Early recognition of decline in pinegrass forage rating from cattle use is barely discernible. The most sensitive indicator appears to be tiller density per unit area as approximated by species direct hits along a three-step transect or density counts from fixed area microplots. A relative measure as species composition is not as sensitive.

Eventually perennial forbs as thickleaf peavine, strawberry, white hawkweed, rough-leaf aster and western yarrow become codominants with pinegrass as forage rating declines. Sheep tend to select out the perennial forbs, especially during late spring and early summer use, and may change species composition to a monospecific stand of pinegrass.

Most stands approach range readiness by early June. Pinegrass is most palatable during this period. By mid-July the perennial forbs and palatable shrubs as serviceberry, bitterbrush, snowberry are preferred. Pinegrass vigor can be maintained by short season grazing in late spring and again during mid-summer dormancy. Season-long use is not recommended for maintainance of pinegrass as a stand dominant.

SITE DESCRIPTION

This guide is restricted to the pumice deposition zone of the Deschutes National Forest, specifically the Sisters Ranger District. Topography is usually flat to slopes of buttes, escarpments, plateaus and major ridges. Slope steepness rarely exceeds 40 percent. Soils are occurring as either a shallow, well defined, layer or well incorporated ashy to cindery airlaid pumice with underlying material of glacial till, lava colluvnum or residuum. Depth to the buried soil various from 10 to 24 inches. Soil profiles have a distinctive A,AC,C horizon sequence.

Mixed conifer/ snowbrush-chinkapin/ pinegrass soil profile with volcanic sand highly mixed over andesite colluvium at 17 inch dept. (1 dm=4 inches)

FORAGE RATING

Forage rating is based upon 1) forage cover, 2) forage composition and 3) plant vigor. These descriptions generally apply to stands grazed by livestock which are in mid to late seral ecological status as defined in FSH 2209.21. Data is not available at this time for adequately rating early and very early ecological status. The shrub layer may be absent where stands are burned within last 15-20 years. In this case use the herbaceous layer descriptions as indicators. A qualitative description for each of four rating classes follows:

Good: Palatable with little or no hedging, all age classes represented. Shrub height varies with site potential and not grazing history. Brackenfern, snowbrush, greenleaf manzanita or chinkquapin, if present, usually are subordinates and often restricted to logging scarification. Pinegrass well distributed with fairly high tiller density per unit area. Perennial forbs as western yarrow, rough-leaf aster, kelloggia. White hawkweed, strawberry, starflower, glaucous penstemon are well distributed but definitely subordinate to pinegrass. Thickleaf peavine may approximate a codominant position in stands burned within last 20 years.

Good Forage rating. Pinegrass dominates with scattered forbs. Stand underburned 30 yrs. ago. Herbage production is 500 lbs. per acre dry weight. Tree crown cover is 60 percent.

Fair: Palatable shrubs as baldhip rose, serviceberry, snowberry and Utah honeysuckle can be moderately to heavily-hedged from browsing pressure but represented by all age classes, may be somewhat aggregated due to tree crown closure or skidding disturbance. Greenleaf manzanita, snowbrush, or chinkquapin may be strong subordinates but usually restricted to logging disturbance. Pinegrass fairly evenly distributed although tiller density per unit area is declining. Perennial forbs can be codominant with pinegrass. Rhizomatous forbs as thickleaf peavine can be very common except under moderate to heavy sheep grazing.

Fair forage rating pinegrass density per unit area thinning although tree crown cover is 40 percent and basal area 150 sq. ft. Herbage production is 220 lbs/acre dry weight.

Poor: Palatable shrubs usually heavily hedged from continued browsing pressure and represented by older age classes with little successful recruitment. Greenleaf manzanita, snowbrush or chinkquapin becomes locally aggressive with site disturbance from grazing or grazing combined with logging. Pinegrass distribution can be patchy, aggregated or entire stand thinning in tiller density/unit area. Perennial forbs dominate over pinegrass in composition and production. Grazing pressure may have lead to larger openings in ground cover devoid of palatable perennial species.

Poor forage rating as a result of historic cattle grazing. Pinegrass tiller density strongly aggregated. Tree basal area is 190 sq. ft. while crown cover is 40 percent. Herbaceous production is 120 lb. per acre dry weight.

Very Poor: The stand is so disturbed by overgrazing that palatable shrubs will not recover to satisfactory densities without artifical regeneration. Unpalatable increaser shrubs may be very common as a result of livestock grazing and logging disturbance. Pinegrass colonies evident but tiller density/unit area is low within colonies. More palatable perennial forbs as thickleaf peavine, hawkweed, rough-leaf aster are scarce. Forbs of low palatability or unpalatable increaser status predominate the ground cover. Timber stands with dense canopies have little evidence of palatable plants in overstory openings.

FORAGE COVER RATING

Use of the three-step method in these plant communities rarely results in greater than 12 direct hits on herbaceous plants per 100 feet of transect in good forage rating. Direct hits on decreaser and palatable increaser herbaceous species for used in calculating a forage cover rating.

Decreaser and palatable increaser herbaceous hits are related to tree crown closure. Tree cover in excess of 85 percent adversely affects direct hits on herbaceous plants. Adjustment for crown closure requires a line intercept estimate of tree and shrub crown along the same transect used to measure loop frequency for plant hits. Measure crown intercept of tree overstory, tree understory along the line using at least 200 feet of transect. The forage cover class is then adjusted downward to reflect the effects of canopy closure. Another influence on palatable increaser plants is site disturbance. Palatable increaser herbaceous plants will increase slightly with site disturbance from logging, grazing or burning. In these cases use the next highest forage cover class given by crown closure:

Tree Crown Intercept	Forage Cover Class
0-50%	9
51-80	6
80	3

A maximum of 25 points is assigned to forage cover. The following table lists the number of points given forage cover according to the number of decreaser and palatable increaser herbaceous hits averaged for a cluster of two or more transects:

	Point Rating by Forage Class			
Number of Hits	12	9	6	3
12 or greater	25			
9-11	20	25		
6-8	15	19	25	
3-5	10	12	16	25
0-2	5	6	8	13

FORAGE COMPOSITION RATING

Forage compostion is affected by tree cover. Decreaser + palatable increaser composition (including shrubs) decreases roughly 2.0 points for every 1 percent increase in tree crown cover over 80 percent. Equations are given for this relationship in the Summary Table.

Adjustment in forage composition for crown closure requires an estimate along the same transects used to determine forage composition. Measure crown intercept of the tree overstory plus tree understory along the line using at least 200 feet of transect.

Mid-seral stand of Mixed conifer/snowbrush chinkapin/ pinegrass dominated by ponderosa pine with 70 percent crown cover. White fir poles are scattered. Stocking is 225 tree per acre and 270 sq. ft. basal area. Degenerated herbaceous layer from tree crown closure. Herbaceous production 40 lbs. per acre dry wt.

High-seral stand of Mixed conifer/ snowberry/ pinegrass dominated by white fir understory. Tree crown cover averages 85 percent with 200 sq. ft. of mature basal area. Forage restricted to openings in canopy and averages 90 lbs. per acre dry wt. Most common forb is shade tolerant thickleaf peavine.

A maximum of 65 points is assigned to forage composition. Shrubs classified as decreasers are included in forage composition rating. Therefore, sampling closest perennials along the three-step transects should include all shrubs in the composition. A sum of the percent composition in herbaceous and shrub decreasers and percent composition in herbaceous palatable increasers is used to rate forage composition. Do not count herbaceous palatable increaser composition in excess of 40 percent.

Forage composition may be adjusted for the effects of tree cover and stand basal area. The following table lists the calculated forage composition value adjusted by tree cover and basal area catagory. Enter the table at the calculated composition column and determine the points from the right-most column. If calculated composition exceeds the limits placed on either basal area or tree cover refer to the next highest class.

Tree Cover:	0-80%	81%+	Composition Point Rating
	81-100	69-80	53-65
	61-80	51-68	40-52
	41-60	35-50	27-39
	21-40	17-34	14-26
	0-20	0-16	0-13

Maximum Limit: 40 percent palatable increaser composition

PLANT VIGOR RATING

Plant vigor responds to annual weather patterns, grazing pressure as well as tree crown closure. Where tree closure exceeds 80 percent attempt to rate vigor from plants growing in forest openings. The following guide is used to rate the vigor that results from livestock grazing on a 10 point scale:

Description	Rating
Average maximum leaf of rhizomatous grass and sedges exceeds 75 percent of seasonal potential as indicated from ungrazed plants. Over 30 percent of plants are seedlings or immature individuals; decadence rare. Sod is dense and spreading into openings. Mature palatable shrubs have vigorous current twigs, seedlings and immature plants common. This vigor exists only in deteriorated range in maxi-upward trend	9 - 10
Average maximum leaf of rhizomatous grasses and sedges between 51 and 75 percent of seasonal potential as indicated from ungrazed plants. Less than a quarter of plants are seedlings or immature individuals. Less than 5 percent of mature plants are decadent. Sod is dense and spreading into openings. Mature palatable shrubs have very few if any decadent branches. This vigor exists on deteriorated range in up trend, range approaching good forage rating	6 - 7 - 8
Average maximum leaf between 26 and 50 percent of seasonal potential. Seedling or immature individuals less than 10 to 15 percent of plants present. Up to 15 percent mature plants are decadent; seedling decadence is common. Sod is firm and holds together when dug and shaken, but no evidence of sod expansion into forests openings. Tree cover exceeding 80 percent is affecting vigor and distribution of most shrubs. Mature palatable shrubs showing some decadent branches and individuals. Stand recruitment about averages mortality. This vigor is experienced in any forage rating class having from moderate down trend to no apparent trend	3 - 4 - 5

Seed stalks produced only under favorable climatic conditions. Average maximum leaf of rhizomatous grasses less than 25 percent of seasonal potential. Seedling or immature individuals not evident or very occasional. Sod is thin, broken, and may contain dead rhizomes and roots. Mature palatable shrubs showing much decadence in crown from grazing and/or tree canopy closure. Undesirable plants as cheatgrass, rab-bitbrush, goldenweed are spreading. This vigor exists on deteriorated range with maximum down trend ..... 0 - 2

FORAGE PRODUCTION

Native, herbaceous production averages 225 pounds per acre dry weight ±90 pounds with an experienced range of 80 to 690 pounds under good forage rating. Climate alone can give a 200 percent variation from one year to another. Herbaceous production is influencd by both tree canopy cover and stand basal area; however, variation in the data prevented development of a good predictive regression equation.

SOIL STABILITY RATING

Soil condition is evaluated using two criteria, the amount of ground surface exposed and evidence of current soil erosion. Both criteria receive an equal weight of 50.

Bare Soil Index

The bare soil index is based on the number of transect hits on bare soil plus pavement, that is, all surface fragments less than 3/4 inch in diameter. Particle size distribution in pumice parent material makes it very difficult to separate bare soil coarse fragments from pavement-sized fragments which result from accelerated erosion. Transect hits are averaged for a cluster. Bare soil attributed to logging is added to naturally occurring bare soil hits. Bare soil rating is then scored by the following table which is adjusted for central Oregon situations:

Bare Soil + Pavement Hits	Index
0- 5	45-50
6-15	35-44
16-25	25-34
26-35	15-24
36+	0-14

Some bare soil is normal for these communities, under stable conditions bare soil rarely exceeds 6 percent.

Current Soil Erosion Index

The following criteria incorporate natural as well as erosion induced by logging and grazing activities:

Description	Rating
No evidence of soil movement. Bare spaces small and well dispersed. Interspaces between colonies of rhizomatous grasses and sedges occupied by young perennial forbs or litter. Pedestalling of perennials and rock fragments occur from frost heaving and not accelerated soil movement. Soil surface friable and porous, not com pacted. Trampling displacement not evident. No active rills or gullies on slopes. Soil deposition from animal burrows or colluvial action and not water or air movement. Loggging disturbance is completely healed. Litter layer almost continous under tree canopy	41 - 50
Soil movement slight and local. Erosion confined to individual bare spaces. Larger interspaces are invaded by rhizomatous perennials. Plant pedestalling from frost heaving, not excessive soil erosion or trampling. Some litter and soil may be deposited on upslope side of perennials due to colluvial movement and soil creep. Soil surface usually porous and friable, being compacted only in interspaces or localized areas. Little evidence of trampling displacement. Sheet erosion light and only from severe storms. Logging disturbance is well covered with needle litter, increaser or invader plants stabilizing scarified soil surfaces	31 - 40
Soil movement moderate. Bare spaces or erosion pavement continous and interconnected. Interspaces between colonies of rhizomatous grasses and sedges partially occupied by young perennials or patches of litter. Plant pedestals due to soil movement, frost heaving, or grazing. Soil and plant displacement occurs from grazing animals. Compaction within interspaces evident on flatter ground. Some soil mounds may occur under shrubs. Lichen lines barely evident on large embedded rocks. Current soil movement occurs in bare soil openings and rodent colonies. Logging disturbance is less than 20 percent of the area. The presence of recent logging places one in this catagory due to risk of future erosion	21 - 30

Description	Rating
Soil movement advanced. Bare soil, surface rock fragments or pavement dominate but site still influenced by vegetation and litter. Large interspaces between perennials are dominated by annuals and occasionally younger perennial plants. Litter layer is lacking in most interspaces and confined to shrub or grass understories. Pedestals common from partial loss of A1 surface soil horizon or trampling displacement. Heaving and crusting of soil surface common. Current soil movement not being effectively arrested by vegetation or litter cover. Active soil movement on skid trails and landings evident as a result of livestock grazing or logging. Rills and gullies apparent or more than 20 percent of area disturbed by logging activity	11 - 20
Soil movement severe. Bare soil or surface rock fragments continuous and form the matrix within which colonies of perennials are growing. Interspaces between perennial plants lack vegetation or dominated by annuals. Litter layer usually absent or confined to immediate influence of perennial plants. Soil compaction may exceed 3 to 5 inch depth on flatter ground. Debris dams and excessive soil buildup occurs against obstructions on steeper slopes. Plant pedestals and cupping out of perennials common. Lichen lines on large embedded rocks are obvious and elevated more than 2 inches above surrounding soil. Overland movement of soil evident, deposition evident from air or water erosion	0 - 10

RECONNAISSANCE FORAGE AND SOIL RATING

The forage and soil rating of a pinegrass-dominated plant community can be approximated by using a 1 square foot plot and estimating one of the following attributes:

a. The average density (number per unit area) of pinegrass stems.

b. The average basal area of pinegrass stems.

c. The average frequency of pinegrass.

d. The average percentage of bare soil plus pavement.

At least 20 to 30 plots should be systematically placed after a random start is used. The average attribute value of the plots is compared to the criteria listed below.

Rating Class	Pinegrass			
	Basal Area	Density	Freq.	%BS + Pavemt.
Good	2.7%+	3.1+	76%+	0-5.0
Fair	1.8-2.6	2.1-3.0	51-75	6.0-10.0
Poor	.9-1.7	1.1-2.0	26-50	11.0-15.0
Very Poor	0- .8	0-1.0	0-25	16.0+

SPECIES LIST

Decreasers

Amal	Amelanchier alnifolia
Lout	Lonicera utahensis
Prem	Prunus emarginata
Putr	Purshia tridentata
Sasc	Salix scouleriana
Caru	Calamagrostis rubescens
Feid	Festuca idahoensis
Fere	Festuca reflexa

Increasers, Palatable

Acci	Acer circinatum
Hodi	Holodiscus discolor
Rupa	Rubus parviflorus
Syal	Symphoricarpus albus
Brca	Bromus carinatus
Brvu	Bromus vulgaris
Cape	Carex pensylvanica
Caro	Carex rossii
Elgl	Elymus glaucus
Mear	Melica aristata
Stoc	Stipa occidentalis
Sihy	Sitanion hystrix
Aggl	Agoseris glauca
Cice	Circium centaureae
Lola	Lathyrus lanszwertii
Lane	Lathyrus nevadensis
Minu	Microseris nutans
Osch	Osmorhiza chilensis
Sein	Senecio integerrimus

Increasers, Unpalatable

Arne	Arctostaphylos nevadensis
Arpa	Arctostaphylos patula
Cach	Castanopsis chrysophylla
Ceve	Ceanothus velutinus
Pamy	Pachistima myrsinites
Rogy	Rosa gymnocarpa
Ruur	Rubus ursinus
Acmi	Achillea millefolium
Apan	Apocynum androsaemifolium
Asra	Aster radulinus
Baca	Balsamorhiza careyana
Casc2	Campanula scouleri
Chme	Chimaphila menziesii
Chum	Chimaphula umbellata
Coum	Comandra umbellata
Cyoc	Cynoglossum occidentale
Epan	Epilobium angustifolium
Frvi	Fragaria virginiana
Hial	Hieracium albiflorum
Hisc	Hieracium scouleri
Kega	Kelloggia galioides
Luar	Lupinus argenteus
Luca	Lupinus caudatus
Peeu	Penstemon euglaucus
Ptaq	Pteridium aquilinum
Pyde	Pyrola dentata
Pypi	Pyrola picta
Smst	Smilicina stellata
Trla2	Trientalis latifolia

Invaders

Anma	Anaphalis margaritacea
ANN	All annuals
Clrh	Clarkia rhomboidea

SUMMARY STATISTICS OF THREE-STEP SAMPLES[1/]

	Mean	95% CI	CV	N
Decreaser + Palatable Increaser Hits 2/	7.9	3.09	.69	12
Decreaser Hits	6.9	2.81	.72	12
Palatable Increaser Hits	1.0	.65	1.1	12
Decreaser + Palatable Increaser Comp. 3/	78.1	8.94	.21	13
Decreaser Composition	58.1	10.61	.33	13
Palatable Increaser Composition	20.0	9.06	.83	13
Total Hits (all plants)	9.0	2.88	.57	12
Species with 80% Presence:				
Calamagrostis rubescens				
hits	4.9	2.82	.73	12
composition	57.1	10.92	.35	13
Lathyrus lanswertii				
hits	1.6	1.04	.74	5
composition	25.2	9.09	.55	9
Hieracium albiflorum				
hits	(data insufficient in calculator)			
composition	2.5	1.37	.93	11
Fragaria virginiana				
hits	(data insufficient in calculator)			
composition	4.4	3.86	1.52	12
Litter	90.1	3.27	.07	13
Moss	.1	.13	1.56	13
Bare soil + Pavement	1.5	.81	1.55	13
Rock	.2	.26	1.36	13

1/ Based on least disturbed stands with less than 85 percent tree crown cover. 95 percent CI: 19 out of 20 samples lies between + stated confidence interval assuming a normal distribution. CV: coefficient of variation = std. deviation/mean. N: sample size is given for samples in which attributes occur.

2/ Excludes shrub direct hits.

3/ Includes decreaser shrubs in composition but they rarely exceed 10 percent.

SUMMARY STATISTICS, RECONNAISANCE RATING GUIDE

Data taken from stands in good forage rating using 1 sq. ft. square microplots.

Attribute	Mean	95% CI	CV	Range	N
Bare soil + pavement cover	.7	.39	1.21	0-2.1	16
Calamagrostis rubescens					
density	2.9	.58	.40	1.7-6.3	16
foliar cover	13.9	4.32	.63	6.1-39.2	16
basal area cover	2.3	.61	.53	1.0-5.0	16
frequency	77.5	6.22	.16	55-100	16

PREDICTION EQUATIONS

1. Decreaser + Palatable Increaser Plant Composition (excluding shrubs)

   = - .58 + 2.96 (% tree cover) - .024 (% tree cover square)

   F = 14.51 with 1 and 11 degrees of freedom
   R^2 = .824
   Sy.x = 6.61 % composition
   (Equation limits: 40 to 110% tree cover)

2. Decreaser + Palatable Increaser Plant Composition (including shrubs)
   = 249.71 -1.96 (% tree cover)

   F = 135.44 with 1 and 5 degrees of freedom
   R^2 = .964
   Sy.x = 3.33% composition
   (Equation limits: 80 to 110% tree cover)

3. Decreaser + Palatable Increaser Plant Composition (including shrubs)
   = 89.55 - .049 (% tree cover)

   F = .262 with 1 and 8 degrees of freedom
   R^2 = .032
   Sy.x = 4.60% composition
   (Equation limits: 40 to 80% tree cover)

   Relationship is non-significant.

4. Decreaser + Palatable Increaser Plant Hits (excluding shrubs)
   = 12.69 - .1027 (% tree cover)

   F = 16.51 with 1 and 11 degrees of freedom
   R^2 = .600
   Sy.x = 1.98 hits
   (Equation limits: 40 to 110% tree cover)

F = F statistic for testing significance of the equation.

R^2 = Coefficient of determination, measures the amount of variation contained in test data that is accounted for by the equation.

Sy.x = Standard error of estimate of sample mean for dependent variable, gives one standard deviation around mean of dependent variable. One standard deviation includes about 2/3rd of the population variation.

ABBREVIATED FORAGE AND SOIL STABILITY GUIDES FOR NON-FOREST AND FOREST VEGETATION WITHIN CENTRAL OREGON PUMICE ZONE

FORAGE COVER RATING (NON-FOREST RANGELAND)

A maximum of 25 points is assigned to forage cover. The three-step method is used to determine the number of loop frequency hits on herbaceous decreaser and palatable increaser plants. Direct hits on shrubs are not included. The following table lists the point rating by number of hits for meadows and sagebrush dominated shrublands:

Number of Hits By Meadow Forage Rating Guide

Tufted Hairgrass Sedge-Rush	Tufted Hairgrass Grass-Forb	Kentucky Bluegrass	Cusick Bluegrass	Cover Rating
9+	30+	22+	19+	20-25
6-8	20-29	14-21	11-18	13-19
3-5	10-19	7-13	5-10	6-12
0-2	0-9	0-6	0-4	0-5

Number of Hits by Non-Forest Shrub Forage Guide

	Sagebrush/Bunchgrass			Sagebrush/ Needlegrass			
Shrub Cover:	>25%	10-25%	<10%	>15%	5-15%	<5%	Cover Rating
	9+	12+	14+	6+	7+	9+	20-25
	6-8	8-11	9-13	4-5	5-6	7-8	13-19
	3-5	4-7	5-8	2-3	3-4	5-6	6-12
	0-2	0-3	0-4	0-1	0-2	0-4	0-5

FORAGE COMPOSITION RATING (NON-FOREST RANGELAND)

A maximum of 65 points is assigned forage composition. Assign one point for each percent composition of herbaceous and shrubby decreasers and palatable increasers. Limits are set on composition which vary by forage guide. Forage composition is rated by entering following table:

Calculated Composition Value By Forage Guide

Tufted Hairgrass Sedge-Rush	Tufted Hairgrass Grass-Forb	Kentucky Bluegrass	Cusick Bluegrass	Sagebrush Bunchgrass	Sagebrush Needlegrass	Composition Rating
44+	81+	75+	68+	70+	70+	52-65
33-43	61-80	56-74	51-67	50-69	50-69	40-51
22-32	41-60	36-55	34-50	30-49	30-49	27-39
11-21	21-40	16-35	17-33	10-29	10-29	14-26
0-10	0-20	0-15	0-16	0-9	0-9	0-13

Composition Limits By Forage Guide:

Guide	Decreasers	Palatable Increasers
Tufted Hairgrass		
Sedge-Rush	Rate comp. down by amount decreasers occur below 25% composition	Forbs 10% Grass 15% (maximums)
Grass-Forb		Forbs 20% Grass 25% (maximums)
Kentucky Bluegrass	None	Forbs 10% Grass 55% (maximums)
Cusick Bluegrass	None	Forbs 10% Grass 10% (maximums)
Sagebrush		
Bunchgrass	Rate decreaser comp. down by amount pal. increasers exceed <12%	Maximum 30% Minimum 12%
Needlegrass	None	None

PLANT VIGOR RATING (NON-FOREST RANGELAND)

Bunchgrass vigor should be based upon tufted hairgrass or Cusick bluegrass in meadows, Idaho fescue, bluebunch wheatgrass and western needlegrass in shrublands. Ignore Sandberg bluegrass since species is very responsive to annual climatic variations.

Description	Rating
Mature bunchgrass plants very leafy and firmly rooted. Rhizomatous grasses with tiller dominated top growth; stems dense and much elongated with respect to leaves. Average maximum leaf or seed stalk length exceeds 75% of seasonal potential as measured from ungrazed plants. Over 30% of plants are seedlings or immature individuals, decadence rare. This vigor exists on previously deteriorated range with maximum upward trend ...	9 - 10

Description	Rating
Mature bunchgrass plants leafy. Mortality occasionally evident within some basal clumps. Root crowns intact, firmly rooted and show few signs of weakness. Rhizomatous grasses with tiller dominated top growth; stems not dense but much elongated with respect to leaves. Average maximum leaf or seed stalk length between 51 and 75% of seasonal potential as measured from ungrazed plants. Less than a quarter of plants are seedlings or immature individuals. Less than 5% of mature plants are decadent. Seedling decadence occasional. This vigor exists on previously deteriorated range which have received an extended period of rest and are approaching good forage rating	6 - 7 - 8
Mature bunchgrass plants moderately leafy. Mortality evident within many clumps. Root crowns displaced with some effort, occasional pedestaling. Rhizomatous grasses with rhizome-dominated top growth; leaves much dominant over stem growth. Average maximum leaf or seed stalk length between 26 and 50% of seasonal potential as measured from ungrazed plants. Seedling or immature individuals less than 10 to 15% of plants present. Up to 15% of mature plants are decadent. Seedling decadence common. This vigor exists on poor range with little or no uptrend or those in better condition which have received early season use over extended period of time	3 - 4 - 5
Mature bunchgrass plants sparsely leafed. Internal portions of clumps show much mortality. Root crowns usually pedestaled or weak and easily displaced. Rhizomatous grasses with rhizome-dominated top growth; stems very sparse as compared to leaf production. Seed stalks produced only under favorable climatic conditions. Average maximum leaf or seed stalk length less than 25% of seasonal potential as measured from ungrazed plants. Seedling or immature individuals not evident or very occasional. This vigor exists on deteriorated range which receive continued over use	0 - 2

SPECIES LIST (NON-FOREST RANGELAND)

Decreasers		Increasers, Palatable	
Agor	Agrostis oregonensis	Agdi	Agrostis diegoensis
Agtr	Agropyron trachycaulum	Caat	Carex athrostachya
Agsp	Agropyron spicatum	Cane	Carex nebraskensis
Caca	Calamagrostis canadensis robusta	Caro	Carex rossi
		Daca	Danthonia californica
Cain	Calamagrostis inexpansa	Daun	Danthonia unispicata
Cafi	Carex filifolia	Kocr	Koleria cristata (shrubland only)
Dain	Danthonia intermedia		
Deca	Deschampsia caespitosa	Pole2	Poa leibergii
Feid	Festuca idahoensis	Pone2	Poa nevadensis
Feru	Festuca rubra	Popr	Poa pratensis
Hobr	Hordeum brachyantherum	Posa	Poa sandbergii
Kocr	Koleria cristata	Sihy	Sitanion hystrix
Phpr	Phleum pratense	Stoc	Stipa occidentalis
Pocu	Poa cusickii	Stth	Stipa thurberiana
Posc	Poa scabrella		
Stwi	Stipa williamsii	Asoc	Aster occidentalis
		Baca	Balsamorhiza careyana
Aggl	Agoseris glauca	Basa	Balsamorhiza sagittata
Crac	Crepis acuminata	Lile	Linium lewisii
Lotr	Lomatium triternatum	Loma	Lomatium martindalei
Mial2	Microseris alpestris	Phha	Phacelia hastata
Pery	Penstemon rydbergii	Pogr	Potentilla gracilis
Sior	Sidalcea oregana	Raal	Ranunculus alismaefolius
Amal	Amelanchier alnifolia	Sein	Senecio intergerrimus
Putr	Purshia tridentata	Taof	Taraxacum officinale
		Trlo	Trifolium longipes
	(With Game Use)		(With Game Use)
Erum	Eriogonum umbellatum	Aggl	Agoseris glauca (shrublands only)
Daun	Danthonia unispicata		
Posa	Poa sandbergii	Erhe	Eriogonum heracleoides
		Lemo	Leucocrinum montanum
		Loma	Lomatium martindalei
		Luar3	Lupinus argenteus

Increasers, Unpalatable

Arar	Artemisia arbuscula
Artr	Artemisia tridentata
Chna	Chrysothamnus nauseosus
Chvi	Chrysothamnus viscidiflorus
Erba	Eriogonum baileyi
Erhe	Eriogonum heracleoides
Erov	Eriogonum ovalifolium
Erum	Eriogonum umbellatum
Habl	Haplopappus bloomeri
Lepu2	Leptodactylon pungens
Tegl	Tetradymia glabrata
Cala	Carex lasiocarpa
Casi	Carex simulata
Juba	Juncus balticus
Juco	Juncus confusus
Jume	Juncus mertensianus
June	Juncus nevadensis
Muri	Muhlenbergia richardsonis
Acmi	Achillea millefolium
Anco	Antennaria corymbosa
Andi	Antennaria dimorpha
Anro	Antennaria rosea
Arfu	Arnica fulgens
Arho	Arabis holboellii
Asca	Aster canescens
Aspo	Astragulus purshii
Astra	Astragulus spp.
Cifo	Cirsium foliosum
Erfi	Erigeron filifolius
Erla	Erigeron lanatum
Frvi	Fragaria virginiana
Lemo	Leucocrinum montanum
Luca	Lupinus caudatus
Lule	Lupinus lepidis
Poan4	Potentilla anserina
Soca	Solidago canadensis
Spum	Spraguea umbellatum

Invaders

Hahi	Haplopappus hirtus
ANN	All annuals
Brte	Bromus tectorum
Irmi	Iris missouriensis
Lonu	Lomatium nudicaule
Sein	Senecio integerrimus (in meadows only)
Zigad	Zigadenus spp. (poisonous)

FORAGE COVER RATING (FOREST RANGELAND)

A maximum of 25 points is assigned to forage cover. The Parker three-step method is used to determine the number of loop frequency hits. Direct hits on decreaser and palatable increaser herbaceous species are used in calculating a forage cover rating. Plant hits are affected by tree crown and/or shrub crown intercept in three forage guides. Measure shrub cover, overstory and understory tree crown intercept along the transect(s), enter table at proper forage guide, number of hits, and crown cover catagory than interpolate point rating from right hand column.

Forage guide:	Pine/Shrub/Fescue				Pine/Shrub/Needlegrass				Pine/Shrub/Sedge			Pine/Sedge	Mixed Conifer/Pinegrass			Point Rating
Tree Cover:	0-40	0-40	0-40	41%+	0-30	0-30	0-30	31%+	0-35	36-45	46%+	N/A	0-50	51-80	81%+	
Scarified Soil:		N/A			Yes	No	No	N/A		N/A		N/A		N/A		
Shrub Cover:	0-10	11-20	21%+	N/A	0-10	0-10	10%+	N/A		N/A		N/A		N/A		
Cover index class:	9	6	3	3	9	6	3	1	35	20	12	9	9	6	3	
Number of decreaser	9-11	7-8	4-5	4-5	9-11	7-8	3.6-5	1.6-2.0	30-39	18-24	11-14	9+	9-11	7-8	4-5	20-25
plus	6-8	5-6	2-3	2-3	6-8	4-6	2.0-3.5	1.1-1.5	19-29	11-17	7-10	6-8	6-8	5-6	2-3	13-19
palatable :	3-5	3-4	0-1	0-1	3-5	2-3	1.0-1.9	.6-1.0	8-18	5-10	4-6	3-5	3-5	3-4	0-1	7-12
increaser	0-2	0-2	0	0	0-2	0-1	0- .9	0- .5	0-7	0-4	0-3	0-2	0-2	0-2	0	0-6
hits																

In situations where hits on decreasers and palatable increasers are greater than that indicated by the tree or shrub cover catagory within a forage guide then use the next highest cover index class as shown in FSH 2209.21 to rate forage cover.

FORAGE COMPOSITION RATING (FOREST RANGELAND)

A maximum of 65 points is assigned forage composition. Assign one point for each percent of herbaceous and shrubby decreaser and palatable increaser composition within limits defined below by forage guide. Composition is affected by tree cover or stand basal area only in Pine/Shrub/Fescue and Mixed Conifer/Pinegrass. Determine calculated composition value, enter table at proper forage guide and tree stocking level than interpolate point rating from right hand column:

Forage guide:	Pine/Shrub Needlegrass	Pine/Shrub Sedge	Pine/Sedge	Pine/Shrub/Fescue				Mixed Conifer/Pinegrass		Composition Point Rating
Tree cover:	NA	NA	NA	0-35%	36-45%	46-55%	> 55%	0-80%	>80%	
Basal area:	NA	NA	NA	0-120ft^2	121-140	141-150	> 150ft^2	NA	NA	
Decreaser	81-100	81-100	80-100	81-100	73-90	57-70	41-50	81-100	69-80	53-65
&	66-80	66-80	60-79	61-80	55-72	43-56	31-40	61-80	51-68	40-52
palatable:	51-65	51-65	40-59	41-60	35-54	29-42	21-30	41-60	35-50	27-39
increaser	36-50	36-50	20-39	21-40	19-36	15-28	11-20	21-40	17-34	14-26
composition	0-35	0-35	0-19	0-20	0-18	0-14	0-10	0-20	0-16	0-13
Forage Composition Limits										
Decreasers:	40% Maximum	None	None	None						
Palatable increasers:	Maximum: 40% Stoc 15% Caro 5% Sihy	Maximum: 20% Stoc 10% Caro 10% Sihy	None	35% maximum				40% maximum		

Where

Stoc: Western needlegrass
Caro: Ross sedge
Sihy: Bottlebrush squirreltail

PLANT VIGOR RATING (FOREST RANGELAND)	Description	Rating
	Mature sedge plants and bunchgrass firmly rooted. Average maximum leaf length exceeds 75% of seasonal potential as measured from ungrazed plants. Over 30% of plants are seedlings or immature individuals, decadence rare. Current twigs of mature squaw currant and bitterbrush are vigorous, seedlings and immature plants common. This vigor exists only on deteriorated range in maximum upward ...	9 - 10
	Mature sedge plants and bunchgrasses firmly rooted. Mortality occasionally evident within colonies or some basal clumps. Average maximum leaf length between 51 and 75% of seasonal potential as measured from ungrazed plants. Less than a quarter of plants are seedlings or immature. Less than 5% of mature plants are decadent. Current twigs of bitterbrush or squaw currant vigorous; seedlings or immature well represented, but not common. Bitterbrush have very few decadent branches. This vigor exists on deteroriated range in up trend or range approaching good forage rating	6 - 7 - 8
	Mortality of mature sedge plants and bunchgrasses evident within many clumps. Root crowns displaced with some effort, occasional pedestalling. Average maximum leaf or seed stalk length between 26 and 50% of seasonal potential as measured from ungrazed plants. Seedling or immature individuals less than 10 to 15% of plants present. Up to 15% of mature plants are decadent; seedling decadence common. Squaw currant or bitterbrush showing some decadent branches and individuals, stand recruitment about averages mortality. Sagebrush, if present, is vigorous and has 5 to 15% young plants. This vigor experienced in any rating class having from moderate down trend to no apparent trend	3 - 4 - 5

Description	Rating
Internal portions of mature sedge plants and bunchgrass clumps show much mortality. Root crowns usually pedestalled or weak and easily displaced. Seed stalks of bunchgrasses produced only under favorable climatic conditions. Average maximum leaf or seed stalk length less than 25% of seasonal potential as measured from ungrazed plants. Seedling or immature individuals not evident or very occasional. Squaw currant or bitterbrush showing much decadence in crown as well as individuals, very few seedlings evident. Sagebrush in excellent vigor, when present with more than 15% young plants. This vigor exists on deteriorated range with maximum down trend	0 - 2

SPECIES LIST (FORESTED RANGELAND)

Decreasers		Increasers, Palatable	
Amal	Amelanchier alnifolia	Rice	Ribes cereum (fescue sites only)
Putr	Purshia tridentata	Cape	Carex pensylvanica (R) (fescue sites)
Rice	Ribes cereum	Caro	Carex rossii
Agcr	Agropyron cristatum	Agda	Agropyron dasystachyum
Agin	Agropyron intermedium	Brca	Bromus carinatus
Agsp	Agropyron spicatum	Brvu	Bromus vulgaris
Brca	Bromus carinatus (long-stolon sedge sites)	Caru	Calamagrostis rubescens (R)
Brvu	Bromus vulgaris (R) (long-stolon sedge sites)	Daun	Danthonia unispicata
		Elgl	Elymus glaucus (R)
Cape	Carex pensylvanica (R)	Posa	Poa sandbergii
Caro	Carex rossii (needlegrass sites)	Pole2	Poa leibergii
Feid	Festuca idahoensis	Powh	Poa wheeleri
Kocr	Koleria cristata	Sihy	Sitanion hystrix (fescue sites)
Mear	Melica aristata	Stoc	Stipa occidentalis (fescue sites)
Sihy	Sitanion hystrix	Stth	Stipa thurberiana
Stoc	Stipa occidentalis	Kega	Kelloggia galioides (R)
		Lala2	Lathyrus lanszwertii (R)
Baca	Balsamorhiza careyana	Lane	Lathyrus nevadensis
Crac	Crepis acuminata		
Lile	Linum lewisii		(With Game Use)
Sein	Senecio intergerrimus	Erhe	Eriogonum heracleoides
Trma	Trifolium macrocephalum	Syal	Symphoricarpus albus
		Aggl	Agoseris glauca
	(With Game Use)	Loma	Lomatium martindalei
Cele	Cerocarpus ledifolius	Lotr	Lomatium triternatum
Erum	Eriogonum umbellatum		
Liru	Lithospermum ruderale		
Pone2	Poa nevadensis		

R = rhizomatous growth form

Increasers, Unpalatable

Arpa	Arctostaphylos patula	Erfi	Erigeron filifolius
Artr	Artemisia tridentata	Erla	Eriophyllum lanatum
Cach	Castanopsis chrysophylla	Frat	Fritillaria atropurpurea
Ceve	Ceanothus velutinus	Frvi	Fragaria virginiana
Chna	Chrysothamnus nauseosus	Gabo	Galium boreale
Chvi	Chrysothamnus viscidiflorus	Hial	Hieracium albiflorum
Erhe	Eriogonum heracleoides	Hisc	Hieracium scouleri
Ernu	Eriogonum nudum	Hofu	Horkelia fusca
Erum	Eriogonum umbellatum	Kega	Kelloggia galioides
Habl	Haplopappus bloomeri	Lemo	Leucocrinum montanum
Lepu2	Leptodactylon pungens	Lual	Lupinus albicaulis
		Luan	Lupinus andersoni
Acmi	Achillea millefolium	Luca	Lupinus caudatus
Anco2	Antennaria corymbosa	Lula	Lupinus latifolius
Andi	Antennaria dimorpha	Lule2	Lupinus lepidus
Ange	Antennaria geyeri	Mial2	Microseris alpestris
Anro	Antennaria rosea	Minu	Microseris nutans
Arco	Arnica cordifolia	Mope	Montia perfoliata
Arho	Arabis holboellii	Peci	Penstemon cinicola
Arpl	Arabis platysperma	Peeu	Penstemon euglaucus
Asra	Aster radulinus	Pehu	Penstemon humilis
Astra	Astragulus spp.	Phha	Phacelia hastata
Casc	Campanula scabrella	Phhe	Phacelia heterophylla
Cali	Castilleja linariaefolia	Smst	Smilacina stellata
Chum	Chimaphila umbellata	Seca	Senecio canus
Cice	Cirsium centaureae	Vipu	Viola purpurea
Epan	Epilobium angustifolium		
Denu3	Delphinium nuttallianum		

Invaders

Brte	Bromus tectorum
ANN	Annual forbs
Ptaq	Pteridium aquilinum pubescens
Zive	Zigademus venenosus (poisonous)

SOIL STABILITY RATING (FORESTED AND NONFORESTED SITES)

Soil stability is evaluated using two criteria, the amount of ground surface exposed and evidence of current soil erosion. Both the criteria receive an equal weight of 50.

Bare Soil Index

The bare soil index is based on the number of transect hits on bare soil plus pavement, that is, all surface fragments less than 3/4 inch in diameter. Particle size distribution in pumice parent material makes it very difficult to separate bare soil coarse fragments from pavement sized fragments which result from accelerated erosion. Transect hits are averaged for a cluster. Bare soil rating is scored by the following table which is adjusted for central Oregon situations.

Bare Soil and Pavement Hits by Forage Guide

Tufted Hairgrass Kentucky Bluegrass	Cusick Bluegrass	Sagebrush Bunchgrass	Sagebrush Needlegrass	Pine - Shrub Fescue	Pine - Shrub Needlegrass	Pine - Shrub Sedge	Pine Sedge	Mixed Conifer Pinegrass	Bare Soil Index
1 < 6	< 16	< 39	< 71	< 9	< 12	< 6	< 9	< 6	45-50
10-6	30-16	47-39	75-71	20-9	25-12	15-6	20-9	15-6	35-44
20-11	45-31	56-48	80-76	30-21	39-26	25-16	30-21	25-16	25-34
30-21	60-46	65-57	85-81	40-31	53-40	35-26	40-31	35-26	15-24
> 30	> 60	> 65	> 85	> 40	> 53	> 35	> 40	> 35	0-14

The following criteria incorporate natural and grazing-induced erosion. They are generalized to include meadow, shrubland and forest rangeland.

Description	Rating
No evidence of soil movement. Bare spaces small, well dispersed, often restricted to rodent colonies. Interspaces between bunchgrasses and shrubs occupied by young perennial plants or litter. Colonies of moss found under shrubs. Litter layer continuous in meadows. Plant pedestalling from frost heaving, not excessive soil erosion or trampling. Soil surface friable, porous, not compacted. Trampling displacement not evident .	41 - 50
Soil movement slight and local. Bare spaces discontinuous and isolated, usually restricted to areas of rodent activity. Moss and litter cover stabilized under shrubs but not interspaces. Litter layer thin but not compacted in meadows. Plant pedestalling from frost heaving, not soil erosion or trampling. Soil surface usually porous and friable, being compacted only in interspaces or localized areas. Slight evidence of trampling displacement. Slight cupping out below bunchgrasses from wind action	31 - 40
Soil movement moderate. Bare spaces or erosion pavement continuous and interconnected. Some concentration of pumice gravels in upper part of A1 horizon. Rhizomatous species as scattered clumps. Plant pedestals due to soil movement, frosting heaving, or grazing. Cupping out below bunchgrasses on steeper slopes. Compaction within interspaces evident on flatter ground. Soil mounds may occur under shrubs. Litter layer thin and compacted in meadows. Pulling up of young perennials may occur during grazing. Current soil movement occurs in bare soil openings and rodent colonies	21 - 30
Soil movement advanced. Bare soil or pumice pavement dominant but site still influenced by vegetation and litter. Litter layer is lacking in most interspaces and confined to shrub or grass understories. Pedestals common from partial loss of A1 surface soil horizon or trampling displacement. Heaving and crusting of soil surface can be common. Current soil movement not being effectively arrested by vegetation or litter cover	11 - 20

Description	Rating
Soil movement severe. Bare soil continuous and forms the matrix within which colonies of perennials are growing. Rhizomatous species occur as very localized, depauperate colonies. Litter layer absent or confined to immediate influence of perennial plants. Soil compacion may exceed 3 to 5 inch depth on flatter ground. Plant pedestals and cupping out of perennials common	0 - 10

RECONNAISANCE FORAGE AND SOIL RATING

The forage and soil rating of a plant community type can be estimated by a reconnaissance sampling technique. A certain number of microplots are systematically placed within a representative stand of a plant community. The microplot size will vary with the density of the vegetation and is given specifically for each forage rating guide. Ocular estimates of foliar cover, density, frequency and either litter cover or bare soil plus pavement are taken from each microplot. The ocular estimates by microplot are averaged for a transect and compared to criteria established for four rating classes. Proper placement of a stand into a rating class would usually require an estimate of all three attributes: foliar cover, density, and frequency. Time and travel contraints may restrict the kind and amount of data collected. In these instances frequency information should be taken as a minimum.

The following tables summarize reconnaissance sampling criteria by forage rating guide:

MEADOW (NON-FOREST) VEGETATION
Ecoclass: MM19, MM19-11, MM90

Sample design: Estimates from 20 to 30 one square foot or .96 square foot circular microplots

Forage Guide:	Kentucky Bluegrass		Tufted Hairgrass			Cusick Bluegrass				
Attribute:	Decreaser		Hairgrass			Bluegrass			% Litter	Rating
Measured	Cover	Freq.	Cover	Density	Freq.	Cover	Density	Freq.	Cover	Class
Criteria:	2.40% +	27% +	31%+	3.0 +	76%+	25%+	2.3+	76%+	80-100	Good
	1.45-2.39	19-26	21-30	2.0-2.9	51-75	16-24	1.4-2.2	51-75	65-79	Fair
	.49-1.44	10-18	11-20	1.0-1.9	26-50	7-15	.7-1.3	26-50	50-64	Poor
	0-.48	0-9	0-10	0-.9	0-25	0-6	.0-.6	0-25	0-50	Very Poor

SAGEBRUSH/NEEDLEGRASS (NON-FOREST) VEGETATION
Ecoclass: SD29-14

Sample design: Estimates from 20 to 30 one square foot microplots

Attribute: Measured	Needlegrass + Squirreltail Foliar Cover		Frequency		% Bare soil + Pavement	Rating Class
Shrub Cover:	>15%	<15%	>15%	<15%		
Criteria:	6%+	16%+	26%+	50%+	< 71%	Good
	4-5	10-15	15-25	30-49	71-80	Fair
	2-3					

SAGEBRUSH/BUNCHGRASS (NON-FOREST) VEGETATION
Ecoclass: SD19-12, SD29-12, SD29-13

Sample design: Estimates from 20 to 30 one-square foot microplots or ten 9.6 square foot circular microplots. One square foot microplot criteria are in parenthesis.

Attribute: Measured	Idaho Fescue + Bluebunch Wheatgrass Cover		Density		Frequency		Bare soil + Pavement		Class
Shrub Cover:					< 20%	> 20%			
Criteria:	17%+	(30%+)	> 2.9	(> 1.9)	(70%+)	(50%+)	< 31%	(<36%)	Good
	8-16	(15-29)	1.5-2.9	(1.0-1.9)	(40-69)	(26-49)	31-40	(36-45)	Fair
	2-7	(5-14)	.8-1.4	(.5-.9)	(20-39)	(11-25)	41-55	(46-60)	Poor
	0-2	(0-4)	0-.7	(0-.4)	(0-19)	(0-10)	56+	(60 +)	Very Poor

PINE/SHRUB/NEEDLEGRASS (FOREST) VEGETATION

Ecoclass: CLS2-13, CLS2-11, CLS2-15, CPS2-12, CPS2-13, CPS3-11, CWS1-14

Sample design: Estimates from 20 to 30 one-square foot microplots or ten 9.6 square foot circular plots. One square foot microplot criteria are in parenthesis. Criteria are not affected by tree cover less than 60% or stand basal areas less than 200 sq.ft. When tree cover or stand basal area exceeds these limits increase forage rating by one class from that class indicated by the criteria.

Attribute: Measured	Aggregated Herbaceous Cover		Palatable Increasers Density		Frequency	% Bare soil + Pavement		Rating Class
Criteria:	21%+	(15%+)	10+	(2.0+)	(70%+)	<21%	(<15%)	Good
	11-20	(9-14)	7-9	(1.6-2.0)	(51-69)	21-35	(15-25)	Fair
	6-10	(5-8)	4-6	(.8-1.5)	(36-50)	36-55	(26-44)	Poor
	0-5	(0-4)	0-3	(0- .7)	(0-35)	56 +	(45+)	Very Poor

PINE/SHRUB/FESCUE (FOREST) VEGETATION

Ecoclass: CPS1-11, CPS2-11, CPS2-16, CPS2-17, CPS3-14, CLS2-14, CLS1-11

Sample design: Estimates from 20 to 30 one-square foot microplots or ten 9.6 square foot circular plots. Criteria apply to stands with less than 40% tree crown cover. For stands greater than 40% tree cover reduce the crown criteria of decreaser plants listed for 9.6 sq. ft. data by 3% for each 10% increase in tree cover over 40%. One square foot microplot criteria are in parenthesis.

Attribute: Measured	Aggregated Herbaceous Decreasers Cover	Density	Frequency	% Bare soil + Pavement		Rating Class
Criteria:	15% + (10%+)	6 + (.8+)	(61% +)	< 13%	(<5%)	Good
	10-14 (5-9)	3-5 (.4-.8)	(31-60)	13-30	(5-20)	Fair
	4-9 (1-4)	1-2 (.1-.3)	(11-30)	31-50	(21-35)	Poor
	(No significant decreasers)		(0-10)	50 +	(36 +)	Very Poor

PINE/SEDGE (FOREST) VEGETATION

Ecoclass: CLS2-12, CLG4-12, CPS2-14, CPS2-15, CPS3-12, CLG4-11, CPG2-12, CWC2-13, CWS1-15, CWS1-13

Sample design: Estimates from 20 to 30 one-square foot microplots or ten 9.6 square foot circular plots. One square foot microplot criteria are in parenthesis.

Attribute:	Herbaceous Decreasers				% Bare soil		Rating
Measured	Cover		Density	Frequency	+ Pavement		Class
Criteria:	21%+	(15%+)	11+	(66%+)	< 11%	(<6%)	Good
	11-20	(9-14)	8-10	(46-65)	11-20	(6-15)	Fair
	6-10	(5-8)	5-7	(31-45)	21-34	(16-30)	Poor
	0-5	(0-4)	0-4	(0-30)	35 +	(30+)	Very Poor

MIXED CONIFER/PINEGRASS (FOREST) VEGETATION
Ecoclass: CWC2-12, CDS6-14

Sample design: Estimates from 20 to 30 one-square foot microplots.

Attribute: Measured	PINEGRASS Basal Area	Density	Frequency	% Bare Soil + Pavement	Rating Class
Criteria:	2.7%+	3.1+	76%+	0-5.0%	Good
	1.8-2.6	2.1-3.0	51-75	6.0-10.0	Fair
	.9-1.7	1.1-2.0	25-50	11.0-15.0	Poor
	0-.8	0-1.0	0-25	16.0+	Very Poor